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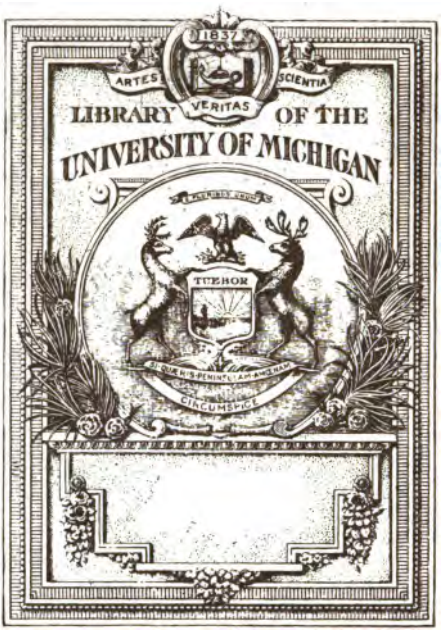

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DEPARTMENT OF THE INTERIOR—U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

THE MANUFACTURE OF COKE IN 1907

By EDWARD W. PARKER,

ADVANCE CHAPTER FROM MINERAL RESOURCES OF THE UNITED STATES
CALENDAR YEAR 1907

WASHINGTON
GOVERNMENT PRINTING OFFICE
1908

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COKE.

By EDWARD W. PARKER.

INTRODUCTION.

In the present chapter, as in the preceding ones of the series, the use of the word "coke" is limited to that product which is obtained by the distillation or partial combustion of bituminous coal in retorts or ovens, and which is generally known as "oven coke," suitable for furnace and foundry use. Ordinary gas-house coke obtained as a by-product in the manufacture of illuminating gas is not considered as coming within the scope of this report. Owing, however, to certain changes which have taken place in the last few years, it is not possible to confine the term coke to that which is used exclusively for furnace or foundry purposes. A not unimportant industry which has developed within the last few years is the preparation of coke for domestic use and for other purposes where smokeless fuel is desired, and this has made it necessary to include in these reports some coke which is not manufactured for strictly metallurgical purposes. The same ovens produce coke which is used for metallurgical and domestic purposes—in fact, one part of the same charge may go to the foundries and furnaces, and another part be crushed and sized for household use. Under such conditions it is manifestly impossible to make a separation of the coke for metallurgical use and to limit the scope of this report to that particular product. In the earlier volumes of this series the only coke considered was that made in ovens most of which, as at the present time, were of the beehive type, and the product was used almost entirely for metallurgical purposes. With the development of the retort ovens which began in 1893, a new feature was added to the industry. In such cases coke is sometimes the primary product and is a strictly metallurgical fuel. In other cases gas, either for illuminating or fuel purposes, is the primary product and coke becomes the secondary product, some of it being used in metallurgi cal establishments while some goes into other manufacturing, railroad, or domestic trade. Whether the coke is a primary or secondary product is determined by the location of the plant and the demands of the particular locality. In a subsequent table a detailed list of the by-product retort coke oven plants in the United States is given, with a statement regarding the purposes for which the coke and the gas are used.

From 1893, when the first plant of 12 by-product ovens was completed by the Semet-Solvay Company, of Syracuse, N. Y., to the close of 1904, there was a steady and noteworthy increase in the construction of retort or by-product ovens in the United States. During the last three years, however, there has been a decided falling off in the number of new ovens built or contracted for. On December 31, 1903, there were 1,335 by-product ovens in course of construction; in 1904 there were 832; in December, 1905, the amount of

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PRODUCTION.

was 4,378,347 tons, or 12.02 per cent in quantity, and of $19,931,092, or 21.76 per cent in value. The average price per ton at the ovens advanced from $2.52 in 1906 to $2.74 in 1907. This average price in 1907 is the highest reported in the 28 years that the statistics have been compiled by the Geological Survey.

Of the total production in 1907, 35,171,665 short tons, or 86.25 per cent, was produced in beehive ovens, against 31,843,090 tons of beehive coke in 1906. The production from retort or by-product ovens in 1907 was 5,607,899 short tons, or 13.75 per cent of the total, against 4,558,127 short tons, or 12.52 per cent of the total, in 1906. The increase of beehive coke in 1907 over 1906 was 3,328,575 tons, while the retort oven product shows an increase of 1,049,772 tons. From this it appears that, while the production of beehive coke increased 10.45 per cent, that of retort oven coke increased 23.03 per cent. It also appears that 23.98 per cent of the total increase in 1907 was in by-product ovens. The total production of coke in 1907 was nearly double that of 1900 and more than three times that of 1897. The production in 1907, with the larger proportionate increase in value, was all made during the first nine months of the year, and was due to the continued extraordinary demand in the iron and steel trade which prevailed until the financial flurry unsettled conditions in October. With the coming of the panic there was a prompt and extensive shutting down of blast furnaces and of rolling mills, and this naturally resulted in a general depression throughout the coking regions, but this falling off in the latter part of the year was not enough to entirely overcome the effects of the activity which prevailed from January to October. As shown in a subsequent table, the average prices for both furnace and foundry cokes ranged much above the average for previous years, and the general average for the year exceeded by 11 cents the previously maximum rate obtained in 1903, which resulted from the abnormal conditions produced by the strike in the anthracite regions of Pennsylvania.

In considering the total value and the average selling price for the coke produced in the United States it should be remembered that in many cases the values are arbitrarily fixed. A considerable number of the coke ovens in this country are operated by large corporations which operate also coal mines and blast furnaces, the coke making being really only an incidental part of the business. In such cases the coke product is sometimes charged against the furnace department at cost and sometimes at a figure based upon the cost of coal mining and coke making, plus a percentage of profit on these operations. The value is not fixed by the market price. In other cases the value is estimated upon the average prices for coke of a similar quality produced and sold in the immediate vicinity. These conditions, however, continue from year to year and do not affect comparisons.

The quantity of coal consumed in the manufacture of coke in 1907 was 61,946,109 short tons, valued at $72,784,851. The value of the coke produced from this coal was $111,539,126, a difference of $38,754,275, which represents the profits on the coking operations less the cost of manufacturing and the expenses of administration and selling. In 1906 the value of the coal used was $62,232,524, and the value of the coke produced was $91,608,034, a difference to cover all expenses of manufacture, administration, and profits of $29,375,510.

Following a year of unprecedented activity in the coking regions 1907 opened with a heavy demand for coke and with prices exceptionally good. During February there was some interference with the shipments due to the weather, and while this hampered trade in some respects, it resulted also in some cases in even higher prices for the coke which the producers were able to deliver. The first few months of the year were marked by a considerable advance in wages, and there was also some advance in freight rates, which added to the cost of coke to the consumer. Notwithstanding the unprecedented production, the general railroad situation, particularly so far as the car supply was concerned, was greatly improved over preceding years. Generally satisfactory conditions continued until the latter part of May, when there was a slight falling off in the production and shipments, but there was not the usual summer slump in the market, the coke trade during the warm months being unusually firm for that period of the year. By the middle of August considerable strength had developed, and this continued until the latter part of October, when the effects of the money troubles were shown in a sharp decline in the demand and in the production. So marked was the decline that Connellsville furnace coke, which in the first part of the year had been selling for from $3.50 to $3.75 per short ton, sold for from $2 to $2.50 in November and December, while foundry coke, which had ranged from $4 to $4.50 the first part of the year, sold for $2.50 to $2.75 at the close.

There were at the close of 1907, 99,680 coke ovens in the United States, against 93,901 in 1906, an increase of 5,779. Of the total ovens in existence in 1907, 4,934 were idle during the entire year, leaving 94,746 active ovens which produced 40,779,564 short tons of coke, an average of 430.4 tons per oven. In 1906 out of the 93,901 coke ovens 5,305 were idle, so that in addition to the new ovens added to the equipment in 1907, the number of ovens idle was 371 less than in 1906. The 88,596 active ovens in 1906 produced 36,401,217 tons of coke, an average of 410.9 short tons per oven. The idle beehive ovens in 1907, as in 1906, were with but few exceptions plants which had not been operated for several years, and which have been practically abandoned. The idle number in 1907 included 81 retort ovens, of which 56 was the bank of Newton-Chambers ovens at Pocahontas, Va. These ovens have not been operated to any extent since their installation several years ago. The total number of by-product recovery ovens in existence at the close of 1907 was 3,892, of which as stated, 81 were idle during the year. The production of 5,607,899 tons of retort oven coke was therefore obtained from 3,811 active ovens. The average production from the retort ovens was accordingly 1,472 tons. The total number of active beehive ovens in 1907 was 90,935, and the total production of beehive coke was 35,171,665 short tons, making an average of 386.8 tons of coke per oven, as against 1,472 tons as the average production for each retort oven. The average production from each beehive oven has increased from 365.8 in 1905 to 373.6 in 1906, and to 386.8 in 1907, while the average production for the retort ovens increased from 1,158.8 tons in 1905 to 1,356 tons in 1906, and to 1,472 tons in 1907. In 1905 the average production from by-product ovens was a little more than three times that of the beehive, while in 1907 it was nearly four times as great.

At the close of 1907 there were 2,546 ovens in course of construction, this being the smallest number reported as in process of construction since 1899. Of the ovens building 330, or nearly 13 per cent, were by-product recovery ovens. Of the 330 retort ovens building 50 were of the United-Otto type at Kokotto, Ohio, and 280 were Koppers regenerative ovens being built at Joliet, Ill., by the Illinois Steel Company.

The number of completed retort ovens has almost doubled in four years, and almost quadrupled in eight years, there being 3,892 ovens in existence at the close of 1907, as compared with 1,956 in 1903, and 1,020 in 1899. The production of by-product coke has increased about four times in five years. In 1902 the production of by-product coke was 1,403,588 tons, or 5.5 per cent of the total; in 1903 it was 1,882,394 tons, or 7.4 per cent of the total; in 1904 it was 2,608,229 tons, or 11 per cent of the total, in 1906 it was 4,558,127 tons, or 12.5 per cent of the total; and in 1907 it was 5,607,899 tons, or 13.75 per cent of the total.

Considering each bank of ovens as a separate establishment, the returns for 1907 show a total of 552 establishments, compared with 532 in 1906, and 519 in 1905. There were 67 idle establishments throughout the year in 1907, compared with 69 in 1906, and 75 in 1905. These 67 idle establishments in 1907 included 16, with a total of 1,872 ovens which were incomplete, or if completed, were not put in blast before the close of the year.

The statistics of the production of coke in 1906 and 1907 are presented by States and Territories in the following tables:

Manufacture of coke in the United States, by States and Territories, in 1906 and 1907.

1906.

State or Territory.	Establishments.	Ovens.		Coal used (short tons).	Yield of coal in coke (per cent).	Coke produced (short tons).	Total value of coke.	Price of coke per ton.
		Built.	Building.					
Alabama	42	9,731	160	5,184,597	58.5	3,034,501	$8,477,899	$2.79
Colorado [a]	15	3,419	80	2,566,196	56.7	1,455,905	4,504,748	3.09
Georgia	2	531	0	128,052	54.9	70,280	277,921	3.95
Illinois	4	309	0	362,163	74.2	268,693	1,205,462	4.48
Indiana	1	48	0	.....	.....	.....	.....	.....
Indian Territory	5	490	0	95,296	52.2	49,782	204,205	4.10
Kansas	5	81	0	2,807	60.5	1,698	4,101	2.42
Kentucky	6	462	0	148,448	49.9	74,064	169,846	2.29
Missouri	2	6	0	0	.....	0	0	.....
Montana	4	555	100	69,045	55.3	38,182	266,024	6.97
New Mexico	4	571	450	261,609	56.5	147,747	442,712	3.00
Ohio	8	575	0	437,567	67.2	293,994	1,013,248	3.45
Pennsylvania	239	47,185	2,373	34,503,513	66.8	23,060,511	54,184,531	2.35
Tennessee	17	2,731	138	929,405	52	483,428	1,350,856	2.79
Utah	2	684	170	(b)	.....	(b)	(b)	.....
Virginia	18	4,641	695	2,296,227	68.7	1,577,659	3,611,659	2.29
Washington	5	216	0	76,896	59.4	45,642	226,977	4.97
West Virginia	141	19,714	353	5,822,619	63.8	3,713,514	8,192,956	2.21
Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Wisconsin, Wyoming	12	1,952	0	2,861,934	72.9	2,085,617	7,474,889	3.58
Total	532	93,901	4,519	55,746,374	65.3	36,401,217	91,608,034	2.52

[a] Includes the production of Utah.

[b] Included with Colorado.

Manufacture of coke in the United States, by States and Territories, in 1906 and 1907—Con.

1907.

State or Territory.	Establishments.	Ovens.		Coal used (short tons).	Yield of coal in coke (per cent).	Coke produced (short tons).	Total value of coke.	Price of coke per ton.
		Built.	Building.					
Alabama	43	9,889	50	4,973,296	61.0	3,021,794	$9,216,194	$3.05
Colorado [a]	16	3,799	50	2,388,911	59.5	1,421,579	4,747,436	3.34
Georgia	2	350	0	136,031	55.1	74,934	315,371	4.21
Illinois	5	309	280	514,983	72.3	372,697	1,737,464	4.66
Indiana	1	28	0	0	.....	0	0	.....
Kansas	6	83	0	11,392	55.0	6,274	19,837	3.16
Kentucky	6	495	0	129,538	51.7	67,068	157,288	2.35
Missouri	1	5	0	0	.....	0	0	.....
Montana	5	567	15	68,948	59.0	40,714	295,174	7.25
New Mexico	4	896	125	446,140	59.4	265,125	840,253	3.17
Ohio	8	600	50	376,759	71.8	270,634	819,262	3.03
Oklahoma (Indian Territory)	5	490	50	38,615	49.4	19,089	82,447	4.32
Pennsylvania	253	51,364	1,337	39,733,177	66.7	26,513,214	67,638,024	2.55
Tennessee	18	2,806	80	825,221	56.6	467,499	1,592,225	3.41
Utah	2	884	0	(b)	.....	(b)	(b)	.....
Virginia	19	5,333	50	2,264,720	68.2	1,545,280	3,765,733	2.44
Washington	5	216	0	85,860	60.6	52,028	293,019	5.63
West Virginia	142	19,688	459	6,536,795	62.9	4,112,896	9,717,130	2.36
Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Wisconsin	11	1,878	0	3,415,723	74.0	2,528,739	10,302,269	4.07
Total	552	99,680	2,546	61,946,109	65.8	40,779,564	111,539,126	2.74

[a] Includes the production of Utah.

[b] Production included with Colorado.

There were 23 States and Territories in which coke was produced in 1907, a decrease of 1 as compared with 1906. Wyoming, which reported a production of coke in 1906, did not make any in 1907. In addition to this there were 8 other States in which the production in 1907 shows a decrease as compared with 1906. These 8 States in which the production decreased were Alabama, Colorado, Kentucky, Maryland, Ohio, Oklahoma, Tennessee, and Virginia, 6 of them being east and 2 west of the Mississippi River. The total decreases amounted to 156,390 tons. The increase in the other 15 States amounted to 4,534,737 tons, making a net increase for the United States of 4,378,347 short tons. The production from by-product ovens increased from 4,558,127 tons to 5,607,899 tons, a gain of 1,049,772 tons, or 23.03 per cent. The production of beehive ovens increased from 31,843,090 tons in 1906 to 35,171,665 tons in 1907, a gain of 3,328,575 tons, or 10.45 per cent. The most notable increase was in Pennsylvania, whose production showed a gain of 3,452,703 tons, or 14.97 per cent. West Virginia's production increased 399,382 tons, or 10.75 per cent. New Mexico's production increased 79.45 per cent, but the gain in tonnage was only 117,378 tons. The production of Illinois was largely increased by the operations of the by-product oven plant at South Chicago, this State showing an increase of 104,004 tons, or 38.71 per cent. In 1905 the State of Illinois produced only 10,307 tons of coke. In 1907 Illinois produced 372,697 tons.

The combined production of Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, and Wisconsin, nearly all of which is the output of by-product ovens, showed an increase of 443,122 tons, or 21.25 per cent.

The increases and decreases in the several States in 1907, as compared with 1906, are shown in the following table:

Increase and decrease in coke production, by States and Territories, in 1907, as compared with 1906 (in short tons).

State or Territory.	Total quantity.		Increase.		Decrease.	
	1907.	1906.	Quantity.	Percentage.	Quantity.	Percentage.
Alabama	3,021,794	3,034,501			12,707	0.41
Colorado [a]	1,421,579	1,455,905			34,326	2.36
Georgia	74,934	70,280	4,654	6.62		
Illinois	372,697	268,693	104,004	38.71		
Kansas	6,274	1,698	4,576	269.49		
Kentucky	67,068	74,064			6,996	9.45
Montana	40,714	38,182	2,532	6.63		
New Mexico	265,125	147,747	117,378	79.45		
Ohio	270,634	293,994			23,360	7.91
Oklahoma (Indian Territory)	19,089	[c] 49,782			30,693	61.65
Pennsylvania	26,513,214	23,060,511	3,452,703	14.97		
Tennessee	467,499	483,428			15,929	3.30
Virginia	1,545,280	1,577,659			32,379	2.05
Washington	52,028	45,642	6,386	13.99		
West Virginia	4,112,896	3,713,514	399,382	10.75		
Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Wisconsin, Wyoming [b]	2,528,739	2,085,617	443,122	21.25		
Total	40,779,564	36,401,217	4,378,347	12.02		

[a] Includes Utah. [b] Not included in 1907 figures. [c] Figures for Indian Territory.

PRODUCTION IN PREVIOUS YEARS.

The earliest record of coke production in the United States is that contained in the census report for 1880. In that year the total production of coke amounted to 3,338,300 short tons. Five years prior to that date, according to statistics compiled by the American Iron and Steel Association, the use of coke in iron furnaces exceeded that of anthracite coal. The same authority states that prior to 1855 most of the iron made in this country was made with charcoal. In that year anthracite took the lead and maintained it until passed by coke in 1875. Six years earlier coke had taken the lead over charcoal. Now very little iron is made with anthracite, and charcoal is used only for making special brands of pig iron. A comprehensive idea of the growth of the coking industry in the United States is obtained by dividing the history of the last twenty years into five-year periods. The average production for the three years prior to 1880 to 1882 was about 4,000,000 tons a year. In the five years from 1883 to 1887, inclusive, the average production amounted to 5,980,459 short tons. The average for the next five years, from 1888 to 1892, was nearly double that of the preceding five years, amounting to 10,533,918 tons. This period was followed by the panic years of 1893, 1894, and 1895, and the coke production showed only a small increase in the next five years, averaging during that time 11,418,536 tons per year. The return of prosperous conditions, which began in 1896, has shown no decided setback since that time, and the production of coke during the five years from 1898 to 1902, inclusive, attained an average of 20,689,347 tons, and exceeded for the first time a total of 25,000,000 tons in 1902. The average production for the last five years was 36,749,805 tons, an increase of nearly 80 per cent over the preceding 5 years.

In the following table are given the statistics of the manufacture of coke in the years 1880 and 1890 and from 1900 to 1907, inclusive:

Statistics of the manufacture of coke in the United States in 1880, 1890, and 1900–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Percentage yield of coal in coke.
		Built.	Building.					
1880	186	12,372	1,159	5,237,741	3,338,300	$6,631,267	$1.99	63.0
1890	253	37,158	1,547	18,005,209	11,508,021	23,215,302	2.02	64.0
1900	396	58,484	5,804	32,113,553	20,533,348	47,443,331	2.31	63.9
1901	423	63,951	5,205	34,297,965	21,795,883	44,415,923	2.039	63.7
1902	456	69,069	8,758	39,604,007	25,401,730	63,339,167	2.49	64.1
1903	500	79,334	6,175	39,423,525	25,274,281	66,498,664	2.63	64.1
1904	507	83,599	4,430	36,531,608	23,661,106	46,144,941	1.95	64.8
1905	519	87,564	4,751	49,530,677	32,231,129	72,476,196	2.25	65.1
1906	532	93,901	4,519	55,746,374	36,401,217	91,608,034	2.52	65.3
1907	552	99,680	2,546	61,946,109	40,779,564	111,539,126	2.74	65.8

The statistics of the production of coke in each State and Territory for the last five years, and the total annual production since 1880, are shown in the following tables. During the twenty-eight years covered by these reports there have been seven in which the production decreased as compared with the preceding year. The most notable decreases were in 1893 and 1894, and were due to the panic and depression which made those years memorable in our recent industrial history. The temporary boom of 1895 was followed by another period of depression in 1896, which was also reflected in a decreased coke production. The slight decrease of 1904 was due to a natural reaction from the abnormal production of the two preceding years, aided by the unsettled conditions of a Presidential year and a slump in the iron trade, which occurred during the summer months.

Quantity of coke produced in the United States, 1903–1907, by States and Territories, in short tons.

State or Territory.	1903.	1904.	1905.	1906.	1907.
Alabama	2,693,497	2,340,219	2,576,986	3,034,501	3,021,794
Colorado[a]	1,053,840	789,060	1,378,824	1,455,905	1,421,579
Georgia	85,546	75,812	70,593	70,280	74,934
Illinois		4,439	10,307	268,693	372,697
Kansas	14,194	9,460	4,425	1,698	6,274
Kentucky	115,362	64,112	79,487	74,064	67,068
Missouri	1,339	2,446	1,580		
Montana	45,107	41,497	31,482	38,182	40,714
New Mexico	11,050	58,259	89,638	147,747	265,125
Ohio	143,913	109,284	277,130	293,994	270,634
Oklahoma (Indian Territory)	49,818	44,808	54,781	49,782	19,089
Pennsylvania	15,650,932	14,861,064	20,573,736	23,060,511	26,513,214
Tennessee	546,875	379,240	468,092	483,428	467,499
Utah	(b)	(b)	(b)	(b)	(b)
Virginia	1,176,439	1,101,716	1,499,481	1,577,659	1,545,280
Washington	45,623	45,432	53,137	45,642	52,028
West Virginia	2,707,818	2,283,086	3,400,593	3,713,514	4,112,896
Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Wisconsin, Wyoming[c]	932,428	1,451,172	1,660,857	2,085,617	2,528,739
Total	25,274,281	23,661,106	32,231,129	36,401,217	40,779,564

[a] Colorado includes Utah. [b] Included with Colorado. [c] Not included in 1907 figures.

Quantity of coke produced in the United States, 1880–1907, in short tons.

1880	3,338,300	1890	11,508,021	1900	20,533,348
1881	4,113,760	1891	10,352,688	1901	21,795,883
1882	4,793,321	1892	12,010,829	1902	25,401,730
1883	5,464,721	1893	9,477,580	1903	25,274,281
1884	4,873,805	1894	9,203,632	1904	23,661,106
1885	5,106,696	1895	13,333,714	1905	32,231,129
1886	6,845,369	1896	11,788,773	1906	36,401,217
1887	7,611,705	1897	13,288,984	1907	40,779,564
1888	8,540,030	1898	16,047,209		
1889	10,258,022	1899	19,668,569		

VALUE OF COKE PRODUCED.

In the following tables are presented statements showing the value of the coke produced in each State and Territory during the last five years and the total value of the coke product of the United States each year since 1880. The effects on the coke trade of the fuel famine caused by the strike in the anthracite region of Pennsylvania are shown by the greatly enhanced values of the coke produced in 1902 and 1903. The extraordinary production in 1905, however, coupled with the high range of prices which obtained during the year, brought the total value up to an amount exceeding by nearly $6,000,000 the previous high-water mark of 1903.

The continued activity and expansion of the iron and steel industries through 1906, added to the scarcity of fuel brought about by the suspension of coal-mining operations on April 1, resulted in a still further advance in prices during 1906 and an increase of $19,131,838 over the high record made in 1905. Throughout the greater part of 1907 the demand from the iron and steel industries continued without abatement, and the production of coke for the first nine months was practically up to oven capacity. The highest prices in the history of the industry were obtained, and the total value shows a further increase over 1906 of $19,931,092.

Total value, at the ovens, of the coke made in the United States, 1903–1907, by States and Territories.

State or Territory.	1903.	1904.	1905.	1906.	1907.
Alabama	$7,622,528	$5,716,413	$7,646,957	$8,477,899	$9,216,194
Colorado	[a] 3,089,783	[a] 2,590,251	[a] 4,157,517	[a] 4,504,748	4,747,436
Georgia	368,351	212,697	224,260	277,921	315,371
Illinois	.....	9,933	27,681	1,205,462	1,737,464
Kansas	50,221	23,485	13,818	4,101	19,837
Kentucky	305,327	138,226	159,659	169,846	157,288
Missouri	5,797	6,115	4,072	.....	.....
Montana	310,882	280,745	211,351	266,024	295,174
New Mexico	31,539	171,976	253,229	442,712	840,253
Ohio	528,142	337,606	970,897	1,013,248	819,262
Oklahoma (Indian Territory)	227,542	209,165	199,424	204,205	82,447
Pennsylvania	38,969,101	25,027,462	42,253,178	54,184,531	67,638,024
Tennessee	1,706,722	905,540	1,184,442	1,350,856	1,592,225
Utah	[b]	[b]	[b]	[b]	[b]
Virginia	2,724,047	1,772,717	2,869,452	3,611,659	3,765,733
Washington	214,776	207,357	251,717	226,977	293,019
West Virginia	7,115,842	3,757,850	6,548,205	8,192,956	9,717,130
Maryland, Massachusetts, Michigan, New Jersey, New York, Wisconsin, Wyoming [c]	3,228,064	4,777,403	5,500,337	7,474,889	10,302,269
Total	66,498,664	46,144,941	72,476,196	91,608,034	111,539,126

[a] Includes value of Utah coke. [b] Included with Colorado. [c] Not included in 1907 figures.

Total value, at the ovens, of the coke made in the United States, 1880–1907.

1880	$6,631,265	1890	$23,215,302	1900	$47,443,331
1881	7,725,175	1891	20,393,216	1901	44,445,923
1882	8,462,167	1892	23,536,141	1902	63,339,167
1883	8,121,607	1893	16,523,714	1903	66,498,664
1884	7,242,878	1894	12,328,856	1904	46,144,941
1885	7,629,118	1895	19,234,319	1905	72,476,196
1886	11,153,366	1896	21,660,729	1906	91,608,034
1887	15,321,116	1897	22,102,514	1907	111,539,126
1888	12,445,963	1898	25,586,699		
1889	16,630,301	1899	34,670,417		

From the preceding statements, showing the quantity and value of the coke produced in a series of years, the following tables have been prepared. These show the average price per ton obtained for the coke product in each State and Territory for the last five years and the average price of the total product since 1880. These average prices are obtained by dividing the total value by the total quantity of coke produced or sold. Although the figures may be accepted as indicating the general tendency of prices, they do not always represent the actual selling value of the coke, as has already been shown. Some of the largest producers of coke consume their entire product in their own blast furnaces. In some such cases the value of the coke is given at the actual cost of production; in others it is based upon the cost of production, adding a percentage of profit on the coking operations; and in still other cases the values are based upon the marketed product of a similar quality of coke in the immediate vicinity. These conditions, however, continue without material change from year to year, so that the prices as given may be generally accepted as indicating the general condition of the market.

As will be seen from the following table, the average price obtained in 1907 was the highest recorded in the twenty-eight years covered by this series of reports. The highest average price previously recorded was in 1903, when, because of abnormal conditions produced by a strike in the anthracite region, the price of coke was advanced 14 cents over the previous high-water mark of 1902. The slump in the iron trade during the summer of 1904 reacted on the coking industry so that the output was reduced and values were totally demoralized, and the average price for the year was the lowest since 1899. This setback, however, was temporary, and the average prices have advanced from $2.25 in 1905 to $2.52 in 1906 and to $2.74 in 1907. It may be confidently stated that 1907 was the most profitable in the history of the coking industry. It may be noted that whereas the average price of bituminous coal made into coke has increased from $1.02 in 1905 to $1.18 in 1907, an advance of 16 cents, or 16 per cent, the price of coke has advanced from $2.25 per ton to $2.74 per ton, an increase of 49 cents, or 22 per cent.

The average prices of coke, by States, from 1902 to 1907, inclusive, and for the United States from 1880 to 1907 are shown in the following tables:

Average price per short ton, at the ovens, of the coke made in the United States, 1903–1907, by States and Territories.

State or Territory.	1903.	1904.	1905.	1906.	1907.
Alabama	$2.83	$2.44	$2.97	$2.79	$3.05
Colorado [a]	2.93	3.28	3.02	3.09	3.34
Georgia	4.31	2.81	3.18	3.95	4.21
Illinois	.....	2.24	2.69	4.48	4.66
Kansas	3.54	2.48	3.12	2.42	3.16
Kentucky	2.65	2.15	2.01	2.29	2.35
Missouri	3.15	2.50	2.58	.....	.....
Montana	6.89	6.77	6.71	6.97	7.25
New Mexico	2.85	2.95	2.83	3.00	3.17
Ohio	3.67	3.09	3.50	3.45	3.03
Oklahoma (Indian Territory)	4.57	4.67	3.64	4.10	4.32
Pennsylvania	2.49	1.68	2.05	2.35	2.55
Tennessee	3.12	2.39	2.53	2.79	3.41
Utah	(b)	(b)	(b)	(b)	(b)
Virginia	2.32	1.61	1.91	2.29	2.44
Washington	4.71	4.56	4.74	4.97	5.63
West Virginia	2.63	1.65	1.92	2.21	2.36
Maryland, Massachusetts, Michigan, New Jersey, New York, Wisconsin, Wyoming [c]	3.46	3.29	3.31	3.58	4.07
Average	2.63	1.95	2.25	2.52	2.74

[a] Includes Utah. [b] Included with Colorado. [c] Not included in 1907 figures.

Average price per short ton, at the ovens, of the coke made in the United States, 1880–1907.

1880	$1.99	1890	$2.02	1900	$2.31
1881	1.88	1891	1.97	1901	2.04
1882	1.77	1892	1.96	1902	2.49
1883	1.49	1893	1.74	1903	2.63
1884	1.49	1894	1.34	1904	1.95
1885	1.49	1895	1.44	1905	2.25
1886	1.63	1896	1.84	1906	2.52
1887	2.01	1897	1.66	1907	2.74
1888	1.46	1898	1.59		
1889	1.62	1899	1.76		

NUMBER OF COKE WORKS IN THE UNITED STATES.

Considering each bank of ovens as a separate establishment, there were, at the close of 1907, 552 establishments manufacturing coke in the United States, an increase of 20 as compared with 1906. These 552 establishments included 16 with a total of 1,872 ovens which were not completed or had not been put in blast during the year, and consequently did not contribute to the production. The ovens of these 16 establishments which had been completed but were not in blast are included in the idle ovens previously mentioned. The incompleted ovens are not considered as idle. In 1906 there were 15 establishments with a total of 1,887 ovens which had not been completed or put in blast during that year. In addition to the 16 new plants that were not operated there were 51 other establishments with a total of 4,614 ovens which were idle throughout 1907. Of these 51 idle establishments 17, or exactly one-third, with a total of 843 ovens, were in the Monongahela River district of West Virginia. Nearly all of the older banks of ovens which were idle during 1907 were comparatively small ones, having an average of 90 ovens each. The majority of them have been idle for several years and some of them

have been practically abandoned. There were, however, only 3 establishments with a total of 161 ovens reported as permanently abandoned in 1907. Deducting the idle plants and those not completed before the end of the year, a total of 67 establishments, it is found that there were 485 active establishments during 1907 with a total of 94,746 ovens, or an average of 195 ovens to each plant.

The total production from the 485 active establishments in 1907 was 40,779,564 short tons, or an average of 84,082 tons for each plant. In 1906 there were 448 active establishments, the total production from which was 36,401,217 short tons, or an average of 81,253 tons for each bank. In 1905 434 active establishments produced 32,231,129 short tons, or an average of 74,265 tons each. The average output for each plant in 1907 was 3.48 per cent greater than 1906, and 13.22 per cent greater than 1905. In 1880, the first year for which these statistics were collected, there were 186 establishments, with an average production from each of 17,948 tons, indicating that the average output from each plant in 1907 was 4.7 times that of 1880.

It should be stated that the word "establishment" as used in this report is intended to designate the number of separate plants or banks of ovens whether operated or idle and whether reported from one central office or not. Different plants controlled or operated by one company are considered separate establishments.

The total number of establishments manufacturing coke in the United States at the end of each decade from 1850 to 1900, and at the end of each year from 1901 to 1907, inclusive, is shown in the following table. The numbers reported in 1850, 1860, and 1870 are for census years; the others are for calendar years:

Number of coke establishments in the United States since 1850.

1850 (census year).... 4	1900, December 31.... 396	1905, December 31.... 519
1860 (census year).... 21	1901, December 31.... 423	1906, December 31.... 532
1870 (census year).... 25	1902, December 31.... 456	1907, December 31.... 552
1880, December 31... 186	1903, December 31.... 500	
1890, December 31... 253	1904, December 31.... 506	

Number of coke ovens in the United States.—In the following table is shown the number of coke ovens in existence in each State and Territory on December 31 for each of the last five years, and at the end of each five years since 1880. The total number of ovens in existence at the close of 1907 (99,680) was 26 per cent more than in 1903, 119 per cent or more than double the number in existence in 1895 and more than eight times the number in existence in 1880.

Number of coke ovens in each State or Territory at the close of each year, 1903–1907.

State or Territory.	1903.	1904.	1905.	1906.	1907.
Alabama	8,764	9,059	9,586	9,731	9,889
Colorado	3,455	3,419	3,421	3,419	3,799
Georgia	500	500	533	531	350
Illinois	155	155	275	309	309
Indiana	36	36	36	48	28
Kansas	91	90	91	81	83
Kentucky	499	499	495	462	495
Maryland	200	200	200	200	200
Massachusetts	400	400	400	400	400
Michigan	75	135	135	150	150
Minnesota	.....	50	50	50	50
Missouri	8	8	6	6	5
Montana	555	520	555	555	567

Number of coke ovens in each State or Territory at the close of each year, 1903–1907—Con.

State or Territory.	1903.	1904.	1905.	1906.	1907.
New Jersey	100	100	100	150	150
New Mexico	126	234	258	571	896
New York	40	352	399	540	540
Ohio	440	539	573	575	600
Oklahoma (Indian Territory)	286	286	388	490	490
Pennsylvania	40,239	42,165	42,608	47,185	51,364
Tennessee	2,439	2,436	2,615	2,731	2,806
Utah	504	504	504	684	884
Virginia	4,251	4,345	4,549	4,641	5,333
Washington	256	256	216	216	216
West Virginia	15,613	16,929	19,189	19,714	19,688
Wisconsin	228	308	308	388	388
Wyoming	74	74	74	74	0
Total	79,334	83,599	87,564	93,901	99,680

Number of coke ovens in the United States on December 31 of each fifth year, from 1880 to 1907.

1880	12,372	1900	58,484
1885	20,116	1905	87,564
1890	37,158	1907	99,680
1895	45,565		

A statement of the number of ovens in course of construction at the end of each year since 1902 is shown in the following table. It is not intended to show by this the increase in the number of ovens from year to year, nor does it include the number of new ovens completed during any one year. It merely exhibits the condition of the industry as shown by plants under construction at the close of each year:

Number of coke ovens building in the United States at the close of each year, 1902–1907.

1902	8,758	1905	4,751
1903	6,175	1906	4,519
1904	4,430	1907	2,546

RANK OF COKE-PRODUCING STATES.

In the following table is shown the relative importance of the different coke-producing States and Territories during the last five years. Pennsylvania, in the manufacture of coke as in the production of coal, has headed the list since these reports have been published. West Virginia and Alabama have for the last twenty-five years been rivals for second place, alternating frequently, and West Virginia has held it three times consecutively, in 1905, 1906, and 1907, the first time in six years that either State has done so. In 1907 West Virginia's production of coke was 36 per cent more than Alabama's, and this practically establishes West Virginia permanently in second place. Virginia and Colorado hold the same relative ranks of fourth and fifth place as they have for the last five years. The most important change noted under the statistics for 1907 is the advance of New York from eighth place in 1906 to sixth place in 1907, this change being due to the operations of the by-product oven plant of the Lackawanna Steel plant at Buffalo. Wisconsin, by reason of the Semet-Solvay ovens at Milwaukee, advanced from thirteenth to seventh place. Tennessee dropped from sixth to eighth place, and Massachusetts from seventh to ninth place. Illinois, because of the

production of the Semet-Solvay ovens at South Chicago, advanced from fourteenth to tenth place.

In the 5 leading States, i. e., Pennsylvania, West Virginia, Alabama, Virginia, and Colorado, by far the larger proportion of the coke is made in beehive ovens. In 5 of the next 6 States, i. e., New York, Wisconsin, Massachusetts, Illinois, and Maryland, practically all of the coke is made in by-product ovens.

Rank of the States and Territories in production of coke, 1903–1907.

State or Territory.	1903.	1904.	1905.	1906.	1907.
Pennsylvania	1	1	1	1	1
West Virginia	2	3	2	2	2
Alabama	3	2	3	3	3
Virginia	4	4	4	4	4
Colorado	5	5	5	5	5
New York	16	11	14	8	6
Wisconsin	15	12	12	13	7
Tennessee	6	7	6	6	8
Massachusetts	7	6	7	7	9
Illinois	23	23	22	14	10
Maryland	8	8	8	9	11
Utah	9	9	11	10	12
Michigan	11	10	9	11	13
Ohio	10	14	10	12	14
New Mexico	21	17	15	16	15
New Jersey	13	13	13	15	16
Minnesota	.....	21	16	17	17
Georgia	14	15	18	19	18
Kentucky	12	16	17	18	19
Washington	18	18	20	21	20
Montana	19	20	21	22	21
Oklahoma (Indian Territory)	17	19	19	20	22
Kansas	20	22	23	23	23
Wyoming	22	24	24	24	.....
Missouri	24	25	25	.....	.....
Indiana	25	.....	.....	.....	.....

COAL CONSUMED IN THE MANUFACTURE OF COKE.

The determination of the quantity of coal consumed in the manufacture of coke is, to a considerable extent, a matter of estimate, as a large quantity of the coal so used is charged directly into the ovens from the mines without having been previously weighed or measured. The only method of ascertaining the quantity of coal thus used is by the amount paid to the miners for mining, which is based sometimes upon the measured bushel or ton and sometimes by the cubical contents of the mine car, all of which standards are apt to differ materially from that of the weighed ton or bushel. There are comparatively few establishments in this country at which the quantity of coal made into coke is accurately ascertained, though as the industry becomes better organized greater attention is being paid to exactness in this regard, and year by year the quantities as presented in the following tables become more accurate. It is still necessary, however, to estimate a large quantity of the coal consumed in the manufacture of coke.

A considerable quantity of the coal which is not run directly from the mines to the coke ovens is crushed and washed before coking. In some of such cases the weight of this coal before washing is given approximately. In other cases the weight after the slate, pyrite, and other impurities have been removed is reported for the weight of the coal charged into the ovens. In still other instances coke ovens have been constructed chiefly for the purpose of utilizing the slack coal produced, in which cases little or no account is taken of the weight

of the coal. It can readily be seen, therefore, that any statement as to the quantity of coal used in the manufacture of coke is necessarily approximate, but as these differences appear from year to year the statistics as collected may be accepted as sufficiently accurate for comparative analysis. As has been stated in previous reports of this series, an apparent discrepancy appears between the statements regarding the quantities of coal consumed in the manufacture of coke as published in the chapter on coal production and those presented herewith. These discrepancies are in general due to the fact that a large quantity of coal is shipped to ovens at a distance from the mine. Where this is the case, the tonnage so shipped would be included in the shipments, the coal statistics showing only the quantity of coal made into coke at the mines.

In 1907 the total quantity of coal made into coke was 61,946,901 short tons, while the quantity of coal reported as made into coke at the mines which is shown in the chapter on the production of coal was 50,289,822 short tons. This indicates that there were 11,657,079 short tons shipped to points distant from the mines before being charged into the ovens.

The quantity of coal used in the manufacture of coke, as obtained for this report, in the several States and Territories, from 1903 to 1907, and the total quantity used for each five years since 1880, are shown in the tables which follow:

Quantity of coal used in the manufacture of coke in the United States, 1903–1907, by States and Territories, in short tons.

State or Territory.	1903.	1904.	1905.	1906.	1907.
Alabama	4,483,942	3,996,578	4,409,854	5,184,597	4,973,296
Colorado [a]	1,776,974	1,376,354	2,368,365	2,566,196	2,388,911
Georgia	146,086	132,270	119,036	128,052	136,031
Illinois		8,131	16,821	362,163	514,983
Kansas	30,503	14,525	6,504	2,807	11,392
Kentucky	247,950	140,139	154,783	148,448	129,538
Missouri	3,004	3,815	2,551	0	0
Montana	82,118	78,303	68,777	69,045	68,948
New Mexico	18,613	94,397	148,469	261,609	446,140
Ohio	211,473	165,487	396,961	437,567	376,759
Oklahoma (Indian Territory)	110,068	98,847	123,389	95,296	38,615
Pennsylvania	23,724,207	22,432,064	31,030,345	34,503,513	39,733,177
Tennessee	1,001,356	718,181	862,320	929,405	825,221
Utah	(b)	(b)	(b)	(b)	(b)
Virginia	1,860,225	1,636,905	2,184,369	2,296,227	2,264,720
Washington	73,119	76,993	85,715	76,896	85,860
West Virginia	4,347,160	3,543,338	5,329,695	5,822,619	6,536,795
Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Wisconsin, Wyoming [c]	1,306,707	2,015,281	2,222,723	2,861,934	3,415,723
Total	39,423,525	36,531,608	49,530,677	55,746,374	61,946,109

[a] Includes coal coked in Utah. [b] Included with Colorado.
[c] Not included in 1907 figures.

Quantity of coal used in the manufacture of coke in the United States each fifth year, 1880–1907.

	Short tons.		Short tons.
1880	5,237,741	1900	32,113,543
1885	8,071,126	1905	49,530,677
1890	18,005,209	1907	61,946,109
1895	20,848,323		

QUANTITY AND VALUE OF COAL USED IN COKE MAKING.

The total quantity and value of the coal consumed in the manufacture of coke in 1906 and 1907, with the quantity and value of coal consumed per ton of coke produced, by States and Territories, are shown in the following tables. The quantity of coal consumed in 1907 was 61,946,109 short tons against 55,746,374 short tons in 1906. The value of the coal used in 1907 was $72,784,851, compared with $62,232,524 in 1906, there being a considerable difference in the value as compared with the quantity. In 1906 the average value per ton of the coal used was $1.12, and in 1907 it was $1.18, a difference of 6 cents. There was also a marked difference in the value of the coke product, which was $91,608,034, or $2.52 in 1906, and $111,539,126, or $2.74 per ton, in 1907.

Quantity and value of coal used in the manufacture of coke in the United States in 1906 and 1907, and quantity and value of same per ton of coke, by States and Territories.

1906.

State or Territory.	Coal used (short tons).	Total value of coal.	Value of coal per ton.	Quantity of coal per ton of coke (short tons).	Value of coal to a ton of coke.
Alabama	5,184,597	$6,582,102	$1.27	1.708	$2.169
Colorado[a]	2,566,196	2,544,677	.992	1.762	1.748
Georgia	128,052	151,659	1.18	1.822	2.15
Illinois	362,163	968,351	2.67	1.347	3.596
Indian Territory	95,296	124,383	1.305	1.914	1.498
Kansas	2,807	3,306	1.177	1.653	1.946
Kentucky	148,448	65,648	.44	2.004	.882
Montana	69,045	210,615	3.05	1.808	5.514
New Mexico	261,609	246,460	.942	1.77	1.667
Ohio	437,567	823,749	1.88	1.488	2.797
Pennsylvania	34,503,513	35,395,374	1.025	1.496	1.533
Tennessee	929,405	955,739	1.028	1.922	1.976
Virginia	2,296,227	2,251,143	.98	1.455	1.426
Washington	76,896	154,964	2.015	1.684	3.393
West Virginia	5,822,619	5,230,561	.898	1.567	1.407
Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Wisconsin, Wyoming	2,861,934	6,523,793	2.28	1.372	3.128
Total	55,746,374	62,232,524	1.116	1.531	1.709

1907.

Alabama	4,973,296	$6,656,742	$1.34	1.646	$2.205
Colorado[a]	2,388,911	2,563,433	1.07	1.680	1.798
Georgia	136,031	167,704	1.23	1.815	2.232
Illinois	514,983	1,343,410	2.61	1.382	3.607
Kansas	11,392	14,777	1.30	1.816	2.361
Kentucky	129,538	66,170	.51	1.933	.986
Montana	68,948	242,327	3.51	1.693	5.942
New Mexico	446,140	618,043	1.39	1.683	2.339
Ohio	376,759	654,588	1.74	1.392	2.422
Oklahoma (Indian Territory)	38,615	56,697	1.47	2.023	2.974
Pennsylvania	39,733,177	42,732,546	1.08	1.499	1.619
Tennessee	825,221	1,108,820	1.34	1.765	2.365
Virginia	2,264,720	2,443,067	1.08	1.466	1.583
Washington	85,860	232,821	2.71	1.650	4.472
West Virginia	6,536,795	5,957,568	.92	1.589	1,462
Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Wisconsin	3,415,723	7,926,138	2.32	1.351	3.134
Total	61,946,109	72,784,851	1.18	1.519	1.792

[a] Includes Utah.

The following table shows approximately the quantity of coal required to produce a ton of coke in 1880, 1890, 1900, and each year since 1901. It will be observed that during the last three years there has been a steady decrease in the consumption of coal per unit of coke, due for the most part to the development of by-product manufacture, in which the yield of coke is considerably more than in beehive ovens.

Coal required to produce a ton of coke, in tons and pounds.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1880	1.57	3,140	1903	1.56	3,120
1890	1.56	3,120	1904	1.544	3,088
1900	1.57	3,140	1905	1.537	3,074
1901	1.57	3,140	1906	1.531	3,062
1902	1.56	3,120	1907	1.519	3,038

YIELD OF COAL IN COKE.

By yield of coal in coke is meant the percentage by weight of the constituents of the coal that remain as coke after the process of coking has been completed. During the last few years the average yield of coal in coke was reported about 64 per cent. This is believed to have been somewhat excessive. For reasons previously stated in connection with the quantity of coal made into coke it is not always possible to obtain exact information on this point, as in many instances the coal is not weighed before being charged into the ovens, and the quantity consumed is largely an estimate, based sometimes upon the measured bushel or car and sometimes upon the cubical contents of the "larry," and sometimes upon the amount paid to the miner for mining the coal. What has been said in regard to the decreased consumption of coal per ton of coke in connection with the preceding tables, due to a larger production in by-product ovens, is also applicable here in regard to the increased percentage yield in the last four years. In 1903 the average percentage yield of coal in coke for the United States was 64.1. In 1904 it had increased to 64.8 per cent; in 1905 to 65.1 per cent; in 1906 to 65.3 per cent, and in 1907 to 65.8 per cent. During this period the percentage to the total coke product of the by-product coke made was in 1903 7.4; in 1904, 11; in 1905, 10.7; in 1906, 12.5; and in 1907, 13.75 per cent. The following table shows the percentage yield of coal in coke in each State and Territory during the last five years, and for the United States each ten years since 1880 and each year since 1901:

Percentage yield of coal in coke, 1903–1907, by States and Territories.

State or Territory.	1903.	1904.	1905.	1906.	1907.
Alabama	60	58.6	58.4	58.5	61.0
Colorado[a]	59.3	57.3	58.2	56.7	59.5
Georgia	58.5	57.3	59.3	54.9	55.1
Illinois	.....	54.6	61.3	74.2	72.3
Kansas	46.5	65	68	60.5	55.0
Kentucky	46.5	45.7	51.4	49.9	51.7
Missouri	61.2	64	61.9	.....	.....
Montana	54.9	53	45.8	55.3	59.0

[a] Average, including Utah.

Percentage yield of coal in coke, 1903–1907, by States and Territories—Continued.

State or Territory.	1903.	1904.	1905.	1906.	1907.
New Mexico	59.4	61.7	60.4	56.5	59.4
Ohio	68	66	69.8	67.2	71.8
Oklahoma (Indian Territory)	45	45.3	44.4	52.2	49.4
Pennsylvania	65.9	66.2	66.3	66.8	66.7
Tennessee	54.6	52.8	54.3	52.0	56.6
Virginia	63.2	67.3	68.6	68.7	68.2
Washington	62.4	59	62	59.4	60.6
West Virginia	62.3	64.4	63.8	63.8	62.9
Maryland, Massachusetts, Michigan, New Jersey, New York, Wisconsin, Wyoming[a]	71.3	72	74.7	72.9	74.0
Total average	64.1	64.8	65.1	65.3	65.8

[a] Not included in 1907 figures.

Percentage yield of coal in coke, 1880–1906.

1880	63	1902	64.1	1905	65.1
1890	64	1903	64.1	1906	65.3
1900	63.9	1904	64.8	1907	65.8
1901	63.7				

CONDITION IN WHICH COAL IS CHARGED INTO THE OVENS.

In the following tables will be found a statement of the condition in which the coal is charged into the ovens in the several States and Territories for the last two years, with a résumé of the corresponding statistics for each five years prior to 1905. It has been found, through several years of experience, that in many of the coke-making districts the quality of the coke has been materially improved through the washing of the coal before being charged into the ovens. This is particularly true in regard to slack coal used for making coke. Practically all of the coal which is reported as mine-run and which is washed before being charged into the ovens is crushed before washing, in order to effect a more satisfactory separation of the slate, pyrite, and other impurities which exist in the coal. From two-thirds to three-fourths of the entire quantity of coal used in coke making is run-of-mine coal, most of which (88 per cent in 1907) is charged into the ovens without being washed. Another lesson which has been learned through experience in coke making in the United States is that the coking process is in many cases facilitated and a better strength and structure of the coke obtained when the coal is disintegrated before being charged into the ovens, and a large quantity of the run-of-mine coal is crushed or disintegrated before coking whether it is washed or not. This coal is not reported as slack. All of the coal charged into by-product ovens is crushed before coking. Partially on account of the extraordinary demand for coke which prevailed during the first nine and one-half months of 1907, the quantity of run-of-mine coal which is washed before being charged into the oven shows a decided decrease as compared with 1906. While the demand was at its height the necessity for the careful preparation of the coal before coking was not so pronounced as in years where consumers were more exacting in their requirements. It is for this reason that the

quantity of unwashed run-of-mine coal charged into the ovens in 1907 shows an increase from 34,748,258 short tons in 1906 to 41,065,584 tons in 1907, while the quantity of washed run-of-mine coal shows a decrease from 7,377,403 short tons in 1906 to 5,589,735 short tons in 1907. It also appears that while there was an increase of 1,415,540 tons, or from 7,784,801 short tons to 9,200,341 tons in the quantity of unwashed slack used, the quantity of washed slack increased only 254,537 tons, or from 5,835,912 tons in 1906 to 6,090,449 tons in 1907. The total quantity of washed coal (run-of-mine and slack) used in 1907 was 11,680,184 tons, or 19 per cent of the total quantity of coal used, as against 13,620,713 short tons, or 24.4 per cent of slack coal used in 1906. This indicates a decrease of 5.4 per cent in the quantity of slack coal used in 1907 as compared with the preceding year. The unwashed coal used in 1907 amounted to 50,265,925 short tons, of which 41,065,584 short tons were run-of-mine and 9,200,341 tons slack. The total quantity of run-of-mine coal washed and unwashed used increased from 42,125,661 tons in 1906 to 46,655,319 tons in 1907, while the slack coal used increased from 13,620,713 short tons to 15,290,790 tons in 1907.

Among the more important coke-producing States it is observed that in Pennsylvania less than 10 per cent of the coal used in 1907 was slack, and that 6.3 per cent of the run-of-mine coal used in 1907 was washed, as against 12.6 per cent in 1906. In West Virginia nearly two-thirds of the coal charged into the ovens is slack, and of this less than 5 per cent in 1907 was washed. In 1906 nearly 10 per cent of the slack coal made into coke in West Virginia was washed. Only a little more than 1 per cent of the run-of-mine coal made into coke in West Virginia is washed. In Alabama from 40 to 60 per cent of the coal used is slack, practically all of which is washed before charging into the ovens. Of the run-of-mine coal used in Alabama in 1906 nearly two-thirds was washed. In Virginia all of the coal made into coke in 1907 was reported as unwashed, though in 1906 10 per cent of the coal was washed. In Colorado and Utah about 70 per cent of the coal made into coke in 1906 and 1907 was slack, and while in 1906 three-fourths of this was washed, in 1907 44 per cent was unwashed. All of the coal used in coke making in New Mexico is slack, nearly all of which is washed. In Tennessee the coal used may be evenly divided between run-of-mine and slack. All of the slack and most of the run-of-mine is washed.

Character of coal used in the manufacture of coke, by States and Territories, in 1906 and 1907, in short tons.

1906.

State or Territory.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
Alabama	1,493,549	1,810,089	121,122	1,759,837	5,184,597
Colorado [a]	4,866	703,440	1,065,353	792,537	2,566,196
Georgia	0	26,488	0	101,564	128,052
Illinois	251,870	0	0	110,293	362,163
Indian Territory	50,802	0	0	44,494	95,296
Kansas	0	0	2,807	0	2,807
Kentucky	1,000	0	65,126	82,322	148,448
Montana	12,935	56,110	0	0	69,045
New Mexico	0	0	0	261,609	261,609
Ohio	356,540	0	38,737	42,290	437,567
Pennsylvania	27,471,566	3,972,712	1,584,152	1,475,083	34,503,513

[a] Includes Utah.

Character of coal used in the manufacture of coke, by States and Territories, in 1906 and 1907, in short tons—Continued.

1906—Continued.

State or Territory.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
Tennessee	81,825	509,532	142,843	195,205	929,405
Virginia	1,014,299	228,347	1,053,581	0	2,296,227
Washington	0	70,685	0	6,211	76,896
West Virginia	2,093,483	0	3,388,877	340,259	5,822,619
Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Wisconsin, Wyoming	1,915,523	0	322,203	624,208	2,861,934
Total	34,748,258	7,377,403	7,784,801	5,835,912	55,746,374

1907.

Alabama	1,020,907	1,697,913	27,433	2,227,043	4,973,296
Colorado [a]	2,956	676,226	1,055,189	654,540	2,388,911
Georgia	0	41,000	0	95,031	136,031
Illinois	311,999	0	194,389	8,595	514,983
Kansas	0	0	11,392	0	11,392
Kentucky	30,632	0	0	98,906	129,538
Montana	18,648	50,300	0	0	68,948
New Mexico	0	0	2,498	443,642	446,140
Ohio	268,637	45,712	36,514	25,896	376,759
Oklahoma (Indian Territory)	0	0	38,615	0	38,615
Pennsylvania	33,589,751	2,267,142	2,566,090	1,310,194	39,733,177
Tennessee	54,397	386,094	0	384,730	825,221
Virginia	1,271,518	0	993,202	0	2,264,720
Washington	0	72,268	0	13,592	85,860
West Virginia	2,451,811	27,067	3,874,817	183,100	6,536,795
Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Wisconsin	2,044,328	326,013	400,202	645,180	3,415,723
Total	41,065,584	5,589,735	9,200,341	6,090,449	61,946,109

[a] Includes Utah

In the following table are given the statistics regarding the character of the coal used in coke making for the years 1890, 1895, 1900, 1905, and 1907:

Character of coal used in the manufacture of coke in the United States, 1890–1907, in short tons.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	14,060,907	338,563	2,674,492	931,247	18,005,209
1895	15,609,875	237,468	3,052,246	1,948,734	20,848,323
1900	21,062,090	1,369,698	5,677,006	4,004,749	32,113,543
1905	31,783,314	3,187,994	8,196,226	6,363,143	49,530,677
1907	41,065,584	5,589,735	9,200,341	6,090,449	61,946,109

COKE MAKING IN BY-PRODUCT OVENS.

According to reports received from the manufacturers of coke in by-product ovens, the total number of this type of oven completed to the close of 1907 was 3,892, against 3,603 in 1906, and 3,159 in 1905. The increase in 1907 over 1906 was 289 ovens. The production of by-product coke in 1907 amounted to 5,607,899 short tons, as against 4,558,127 short tons in 1906 and 3,462,348 tons in 1905. The increase in 1907 over 1906 amounted to 1,049,772 short tons, or 23 per cent. The increase in 1906 over 1905 was 1,095,779 short tons, or 31.6 per cent. Of the 3,892 ovens in 1907, 81 were idle, the idle ovens being 25 Semet-Solvay ovens at Sharon, Pa., and 56 Newton-Chambers ovens at Pocahontas, Va., which have not been in practical operation since they were first installed. In 1906, out of the 3,603 by-product ovens, 241 were idle.

The production of by-product coke in 1907 was from 3,811 active ovens, the average output from each of which was 1,472 short tons of coke, as compared with the average production for each oven in 1906 of 1,356 short tons, and in 1905 of 1,158.8 tons. The average production from beehive ovens in blast in 1907 was 386.8 short tons, as compared with 373.6 tons in 1906, and 365.8 tons in 1905. The quantity of coal consumed in the manufacture of the 5,607,899 tons of by-product coke in 1907 was 7,506,174 short tons, indicating a yield of coal in coke of 75 per cent. In 1906 the average percentage yield of coal in coke in by-product ovens was 73.6 per cent, and in 1905 it was 74.8 per cent. This is a much larger yield than it is possible to obtain in beehive ovens, as a portion of the fixed carbon in the coal is unavoidably burned in beehive-oven practice, while in the retort oven the operation is one of distillation only without the admission of air, and all of the fixed carbon remains as coke. As previously shown, the average yield of coal in coke, including the output of by-product recovery ovens in the United States for the last few years has been about 65 per cent, and this is probably higher than the actual results obtained. The increase in the production of by-product coke is responsible for the average yield of coal in coke increasing in each of the last five years from 64.1 per cent in 1903 to 64.8 per cent in 1904, to 65.1 per cent in 1905, to 65.3 in 1906, and to 65.8 in 1907.

At the risk of being charged with repeating what has already been said, the writer again calls attention to the tenacity with which coke manufacturers of the United States cling to the beehive-oven practice of coke making and to the comparatively slow increase which has characterized the retort-oven method of manufacture as developed in the United States, particularly in the last three of four years. From 1900 to 1903 there was a gratifying condition shown by the number of ovens in course of construction at the end of each year, there having been between 1,000 and 1,500 ovens building during these years, many of which were completed during the period. The number of by-product ovens completed increased from 1,956 in 1903 to 2,910 in 1904, with 832 under construction at the end of that year. Part of these ovens under construction at the end of 1904 were completed in 1905, and some in 1906, the total number of completed ovens at the close of the latter year being 3,603. The amount of new work under way during the last four years, however, has shown a marked decrease as compared with the preceding four years. At the end of 1905 there were

only 417 ovens under construction, and at the end of 1906 the number of ovens under construction was reduced to 112. Some additional new work was begun in 1907, and the number of ovens under construction at the close of that year was 330, of which 280 were the experimental plant of Koppers regenerative by-product ovens building by the Illinois Steel Company, at Joliet, Ill., it being reported that it was the intention of the United States Steel Corporation to construct 1,000 of this type of oven at Gary, Ind., if this experimental plant proved satisfactory. The other 50 ovens building at the close of 1907 are an addition to the United Otto plant at Hamilton, Ohio, doubling the number of ovens at that place.

When the economies which may be effected by the use of the retort ovens have been so clearly demonstrated, not only by the plants which have been constructed in the United States, but more emphatically through the much more extensive development of by-product coke manufacture in Europe, the condition in the United States, as shown by the statistics for the last four years, is somewhat difficult to understand. The economy shown by the higher yield of coal in coke has already been referred to, and, as previously stated, the production of coke in the by-product ovens of the United States in 1907 amounted to 5,607,899 short tons, valued at $21,665,157. The total value of by-products obtained in the manufacture of this coke was $7,548,071, this value and the quantity being distributed as follows:

Value of by-products obtained in manufacture of coke in retort ovens in 1907.

	Quantity.	Value.
Gas.....M cubic feet..	20,516,731	$3,130,839
Tar.....gallons..	53,995,795	1,242,530
Ammonia, sulphate or reduced to equivalent in sulphate.....pounds..	125,372,360	3,174,702
Total.....	.....	7,548,071

The gas included in the foregoing statement is the "surplus" not consumed in the coking process, and which is either sold or used at manufacturing establishments operated in connection with the coke-oven plant. In a few instances where the surplus gas is consumed by the producing companies the quantity is not measured, nor was any value placed upon it in the reports made to the Survey. In such cases careful estimates have been made, based upon the average surplus gas obtained from similar coals used at ovens of the same type. The value, similarly estimated, has been placed at from 10 to 15 cents per thousand cubic feet.

The coal consumed in retort ovens in 1907 amounted to 7,460,587 short tons. The quantity of coal used in beehive ovens was 54,485,522 short tons, from all of which the possible by-products are apparently wasted. Assuming that the coal consumed in beehive ovens was of the same average quality as that charged into the retort ovens and that the prices would be not less than 80 per cent of those ruling in 1907, the value of recoverable products which were thus apparently wasted last year amounted to $44,000,000, a sum equal to nearly 80 per cent of the total value of all the coal used in beehive ovens during the year. At the prices which prevailed in 1907 the value of the by-products wasted in beehive coke ovens was a little over $55,000,000.

The value of the by-products from the retort ovens in 1907 was a little more than one-third the value of the coke produced in them.

It should be remembered, however, that beehive ovens are located in the coal mining regions and that the cost of the coal charged into them represents only a little more than that represented by the expense of mining the coal, whereas in locating by-product recovery plants provision must be made for utilizing or marketing the by-products. It is for this reason that in the much larger number of cases the recovery plants are established near the larger cities and at considerable distances from the mining regions, and the expense of transportation is added to the mining cost of the coal. Hence it is that the value of the 7,506,174 tons of coal charged into by-product ovens in 1907 was $15,874,430, or over $2 per ton, while the 54,485,522 tons of coal used in beehive ovens was $56,956,008, or $1.05 per ton. It must also be remembered that the original cost of installation for a by-product recovery plant is from 4 to 5 times that of a beehive plant of equal capacity. These disadvantages are in turn partly offset by the higher percentage yield of coke in the retort ovens and a lower delivery charge on the coke produced. In the case of beehive coke, railroad transportation expense is borne by the coke, while in retort oven practice all, or nearly all, of the freight charge is borne by the coal.

The total value of the 5,607,899 tons of by-product coke produced in 1907 was $21,665,157, an average of $3.86 per ton. The value of the 35,171,665 tons of beehive coke made in 1907 was $89,873,969, or $2.56 per ton. If we consider that the difference in the value of the by-product coke and beehive coke was due only to the difference in freight charges, then the total value of the entire product of beehive coke made in 1907 would, if made in retort ovens close to the market, have been worth $135,750,000. Add to this the value of the by-products that should have been recovered of $44,000,000, at 80 per cent of the market price in 1907, the total value of the coke and by-products would have amounted to nearly $180,000,000 instead of the value of $89,873,969 for the beehive coke alone. The value of the coal charged into these ovens would have been $108,879,870 instead of $56,956,008. Carrying the hypothesis further, the difference between the value of the coke and by-products if the coal had been coked in retort ovens and the value of the coke alone from the beehive ovens was, say, $90,000,000. From this should be deducted the difference between what the value of the coal would have been at retort ovens, and what it was at beehive ovens, i. e., $52,000,000. The remainder ($38,000,000) less the difference in operating expenses, wear and tear, interest on capital, etc., may be considered as approximately the actual net loss in value as the result of beehive coke production compared with by-product coke practice in 1907.

One of the reasons that has been given for the apparent lack of progress in retort oven building in the last four years is the lack of profitable markets for the by-products of coal tar, and this has contributed to the backwardness of the United States in the development of the chemical industries depending upon coal tar as a raw material, and yet this country is importing coal tar products to the value of several million dollars annually. It is also well known that the development of the coal-briquetting industry has been retarded

because of the lack of assurance of a satisfactory supply of suitable coal tar pitch for binding material, and there is also an increasing demand for creosoting oils for the preservation of timber.

There does not appear to be any trouble in disposing of the ammonia, for which a good demand exists, and the practicability of long distance transmission of the gas has been successfully demonstrated, thus insuring markets for the surplus of this retort-oven product. The United Otto oven plant at Camden, N. J., is distributing gas to Plainfield, New Brunswick, and other cities and towns, the maximum distance being 83 miles.

At the present time, when the conservation of the natural resources of the United States is being so earnestly discussed, this matter of waste in coke manufacture is one which might well be given serious consideration.

The first plant of by-product ovens built in the United States was one of 12 Semet-Solvay ovens at Syracuse, N. Y. It was completed in 1893, and the production in that year amounted to 12,850 tons. This plant has since been increased to 40 ovens. The first plant of United Otto ovens was constructed at Johnstown, Pa., and consisted of 60 ovens operated in connection with the (now) Cambria Steel Company. The main difference in these two types of oven lies in the arrangement of the flues for the combustion of the gases used in heating them. In one the flues are vertical and in the other they are horizontal. Most of the by-product ovens constructed in this country have been one of these two designs. At the close of 1907 there were 1,270 Semet-Solvay ovens in operation, with 25 idle; of the United Otto type there were 2,002 completed and 50 building. In addition to these there were 387 Rothberg ovens in operation during the year, but no new ones of this type were under construction. There were also 152 Newton-Chambers ovens in operation at Vintondale, Pa., during 1907, but no by-products, except of an experimental character, were obtained. The plant of 56 Newton-Chambers ovens constructed at Pocahontas, Va., has not been in operation for several years.

In the following table is shown the record of by-product coke making since 1893, when the first plant was established at Syracuse, N. Y.:

Record of by-product coke making, 1893–1907.

Year.	Ovens.		Production (short tons).	Year.	Ovens.		Production (short tons).
	Built.	Building.			Built.	Building.	
1893	12	0	12,850	1901	1,165	1,533	1,179,900
1894	12	60	16,500	1902	1,663	1,346	1,403,588
1895	72	60	18,521	1903	1,956	1,335	1,882,394
1896	160	120	83,038	1904	2,910	832	2,608,229
1897	280	240	261,912	1905	3,159	417	3,462,348
1898	520	500	294,445	1906	3,603	112	4,558,127
1899	1,020	65	906,534	1907	[a] 3,892	[b] 330	5,607,899
1900	1,085	1,096	1,075,727				

[a] Includes 1,295 Semet-Solvay, 2,002 United Otto, 387 Rothberg, and 208 Newton-Chambers ovens.
[b] Includes 50 United Otto, and 280 Koppers ovens.

In the following table is shown the record of by-product coke ovens, by States, at the close of 1903–1907:

Record of by-product ovens, by States, 1903–1907.

State.	Dec. 31, 1903.		Dec. 31, 1904.		Dec. 31, 1905.		Dec. 31, 1906.		Dec. 31, 1907.	
	Built.	Building.	Built.	Building.	Built.	Building.	Built.	Building.	Built.	Building.
Alabama	240	40	240	40	280	0	280	0	280	0
Illinois	0	120	0	120	120	0	160	0	160	280
Maryland	200	0	200	0	200	0	200	0	200	0
Massachusetts	400	0	400	0	400	0	400	0	400	0
Michigan	75	60	135	0	135	15	150	0	150	0
Minnesota	0	50	50	0	50	0	50	0	50	0
New Jersey	100	0	100	0	100	50	150	0	150	0
New York	40	500	352	658	399	0	540	0	540	0
Ohio	50	66	116	14	130	0	130	0	155	50
Pennsylvania	675	419	1,061	0	1,089	272	1,207	112	1,471	0
Virginia	56	0	56	0	56	0	56	0	56	0
West Virginia	120	0	120	0	120	0	120	0	120	0
Wisconsin	0	80	80	0	80	80	160	0	160	0
Total	1,956	1,335	2,910	832	3,159	417	3,603	112	3,892	330

The distribution by States and by kinds of by-product ovens built and building in the United States at the close of 1907 is shown in the following table:

Kinds of by-product coke ovens built and building in the United States, by States, at the close of 1907.

State.	Semet-Solvay.		United Otto.[a]		Rothberg.		Newton-Chambers.		Total.	
	Built.	Building.	Built.	Building.	Built.	Building.	Built.	Building.	Built.	Building.
Alabama	280	.....	.....	.....	.....	.....	.....	.....	280	0
Illinois	160	.....	.....	.....	.....	.....	.....	.....	160	[b]280
Maryland	.....	.....	200	.....	.....	.....	.....	.....	200	0
Massachusetts	.....	.....	400	.....	.....	.....	.....	.....	400	0
Michigan	120	.....	30	.....	.....	.....	.....	.....	150	0
Minnesota	.....	.....	50	.....	.....	.....	.....	.....	50	0
New Jersey	.....	.....	150	.....	.....	.....	.....	.....	150	0
New York	70	.....	188	.....	282	.....	.....	.....	540	0
Ohio	.....	.....	50	50	105	.....	.....	.....	155	50
Pennsylvania	385	.....	934	.....	.....	.....	152	.....	1,471	0
Virginia	.....	.....	.....	.....	.....	.....	56	.....	56	0
West Virginia	120	.....	.....	.....	.....	.....	.....	.....	120	0
Wisconsin	160	.....	.....	.....	.....	.....	.....	.....	160	0
Total	1,295	.....	2,002	50	387	.....	208	.....	3,892	330

[a] Includes the Otto-Hoffmann and Schniewind types.
[b] Koppers' regenerative ovens.

The following table, originally compiled by Mr. Albert Ladd Colby, has been revised by Mr. C. G. Atwater, of the United Coke and Gas Company, Whitehall Building, New York City, and by Mr. W. H. Blauvelt, of the Semet-Solvay Company, Syracuse, N. Y.

This table shows, in addition to the number of ovens at each by-product oven plant in the United States and Canada, the uses to which the coke and gas are put, the dates the plants were put in operation, and other interesting information regarding their construction and operation. The statement includes also the garbage-carbonizing plant of Semet-Solvay ovens at Boston, Mass. This plant was originally planned for 400 ovens, but only 7 were completed. The plant has since been partially wrecked by fire and has been dismantled.

Complete list of by-product coke-oven plants of the United States and Canada, January 1, 1908.

State.	Town.	System.	Name of company.	Number of installments.	Date put in operation.	Number of ovens.	Uses of coke.	Uses of surplus gas.	Remarks.
Mass....	Boston.....	Semet-Solvay..	The New England Sanitary Product Co. (plant for carbonizing garbage tankage).	.....	1898.....	7	Fertilizer base....	Fuel.....	Damaged by fire and dismantled.
	Everett.....	Otto-Hoffmann	New England Gas and Coke Co.	.....	June, 1899 ..	400	Domestic and locomotive in about equal proportion.	Illuminating gas and fuel gas; 6,500,000 to 7,500,000 cubic feet daily of illuminating gas.	First illuminating-gas system installed.
N. Y....	Syracuse.....	Semet-Solvay..	Solvay Process Co...	First...	Jan., 1893...	12	Burning limestone; also iron foundry.	Fuel.....	First by-product plant in United States. Main purpose to obtain ammonia for alkali works.
				Second .	1896.....	a 25			
				Third...	Bet. 1900–1903.	a 40			
	Geneva.....	.....do.....	The Empire Coke Co .	First...	Aug., 1904..	30	Foundry and domestic.	Illuminating.....	
	Buffalo.....	United Otto....	Lackawanna Steel Co.	....do...	May, 1904...	b 564	Blast furnace.....	Fuel gas.....	Used stamped coal, but went back to top-charging, 1907.
	.....do.....	Rothberg.....	.....do.....	....do..	.....	282	.....do.....	.....do.....	
N. J.....	Camden.....	Otto-Hoffmann	South Jersey Gas, Electric, and Traction Co.	....do...	About Jan., 1903.	100	Foundry and domestic (domestic coke crushed and sized for sale).	Illuminating gas and fuel gas 2,500,000 to 3,000,000 cubic feet. Illuminating gas pumped daily under 10 pounds pressure to Trenton, 38 miles distant. In 1906 extended delivery of illuminating gas to New Brunswick and Plainfield, 83 miles from Camden. Towns now included: Camden, Bordentown, Woodbury, Trenton, New Brunswick, Plainfield, and smaller towns.	First to install enrichment by benzol transfer.
		United Otto....	.....	Second .	July, 1906...	50			
Pa.....	Dunbar.....	Semet-Solvay ..	The Dunbar Furnace Co.	First...	Aug., 1896 ..	50	Blast furnace.....	Fuel gas.....	
				Second .	July, 1903...	60	.....	.....	
	Chester....	.....do.....	The Suburban Gas Co.	First ..	Apr., 1904 ..	40	Blast furnace.....	Illuminating.....	
	Sharon.....	.....do.....	The Carnegie Steel Co.	....do...	Oct., 1896...	25	.....do.....	Fuel gas.....	
	South Sharon..	United Otto....	Sharon Coke Co.....	....do...	July, 1903...	212	.....do.....	.....do.....	

	Glassport	Otto-Hoffmann	Pittsburg Gas and Coke Co.	.....	Feb., 1897	120	Blast furnace and domestic. Installed a crushing outfit in 1905.	Illuminating gas and fuel gas to McKeesport.	
	Johnstown	....do	Cambria Steel Co	First	Nov., 1895	60	Blast furnace	Fuel gas and power gas	60 ovens old type Otto-Hoffmann.
				Second	Mar., 1899	100	....do	....do	100 ovens United Otto.
				Third	Sept., 1904	100	....do	....do	Do.
				Fourth	Feb., 1907	112	....do	....do	
	Lebanon	Semet-Solvay	Pennsylvania Steel Co	First	July, 1904	90	....do	Semet-Solvay Co. delivers surplus gas to Pennsylvania Steel Co., which sells it to American Iron and Steel Mfg. Co. for use in heating furnaces and gas engine.	Erected by Semet-Solvay Co. at expense of Pennsylvania Steel Co. "Five high" type of oven.
	....do	Otto-Hoffmann	Lackawanna Steel Co	....do	Mar., 1903	232	....do	Fuel gas	Have gone back to top-charging since resumption.
	Steelton	Semet-Solvay	Pennsylvania Steel Co	....do	Jan., 1907	120	....do	....do	"Five high" type of oven.
W. Va	Benwood	....do	National Tube Co	....do	Oct., 1898	60	....do	....do	
				Second	Mar., 1901	60			
Md	Sparrows Point	United Otto	Maryland Steel Co	First	Mar., 1903	200	Blast furnace	Illuminating gas for city of Baltimore, 11 miles distant; 4,000,000 cubic feet daily.	
Ala	Ensley (near Birmingham).	Semet-Solvay	Tennessee Coal, Iron and R. R. Co.	....do	Oct., 1898	120	....do	Fuel gas	
				Second	Mar., 1902	120	....do	....do	
	Tuscaloosa	....do	Central Iron and Coal Co.	First	Since 1905	40	....do	....do	"Five high" type of oven.
Ohio	Hamilton	Otto-Hoffmann	Hamilton Otto Coke Co.	....do	Apr., 1901	50	Mostly domestic; some foundry. Installed crushing outfit 1905.	Illuminating gas for Hamilton; also power gas.	
	....do	United Otto	....do	Second	Not completed.	50	Blast furnace	....do	
	Cleveland	Rothberg	Cleveland Furnace Co. Wellman-Seaver-Morgan Co.	First	About Apr., 1905.	80	....do	Fuel gas	Use stamped coal.
				Second		25	....do	....do	
Ill	Joliet	Koppers	Illinois Steel Co	First	Not completed.	280	....do	Fuel and power	
	South Chicago on Calumet River.	Semet-Solvay	By-products Coke Corporation.	....do	Dec., 1905	120	Blast furnace, foundry, and domestic.	Illuminating	
				Second	Dec., 1906	40			
Wis	Milwaukee	....do	Milwaukee Coke and Gas Co.	First	Mar., 1904	80	....do	....do	
				Second	Mar., 1906	80			
Mich	Delray	....do	The Solvay Process Co.	First	Sept., 1901	30	Furnace, foundry, domestic, and lime-burning.	Illuminating	
				Second	Nov., 1902	30			
				Third	Mar., 1906	60			

[a] Increased to.

[b] Contracted for; 188 completed.

Complete list of by-product coke-oven plants of the United States and Canada, January 1, 1908—Continued.

State.	Town.	System.	Name of company.	Number of installments.	Date put in operation.	Number of ovens.	Uses of coke.	Uses of surplus gas.	Remarks.
Mich....	Wyandotte.....	United Otto....	Michigan Alkali Co...	First ...	Oct., 1902...	15	Burning limestone.	Fuel gas.....	Use the by-products in their works.
				Second .	Aug., 1906 .	15			
Minn....	Duluth.....	.....do.....	Zenith Furnace Co ...	First ...	July, 1904...	50	Blast furnace.....	Illuminating gas for Duluth.	
Nova Scotia.	Halifax.....	Semet-Solvay ..	People's Heat and Light Co.	.....	Apr., 1898 ..	10	Domestic.....	Illuminating gas for Halifax.	Originally built by another system. Not in operation.
	Sydney.....	Otto-Hoffmann	Dominion Iron and Steel Co.	.....	Dec., 1900...	500	Blast furnace.....	Fuel gas.....	

IMPORTS AND EXPORTS.

The following table gives the quantity and value of coke imported and entered for consumption in the United States from 1902 to 1907, inclusive. In the reports of the Bureau of Statistics of the Department of Commerce and Labor, from which these figures are obtained, the quantities are expressed in long tons of 2,240 pounds. These have been reduced to short tons in order to make them conform to the standard unit of this report.

Coke imported and entered for consumption in the United States, 1902–1907, in short tons.

1902	140,489	$423,775	1905	203,142	$796,545
1903	142,776	437,625	1906	147,819	570,150
1904	180,855	648,521	1907	135,968	596,366

The quantity of coke exported from the United States has increased each year since 1900. The exports for the last six years are shown in the following table, the quantities in this case also being reduced to short tons:

Coke exported from the United States since 1902, in short tons.

1902	439,590	$1,785,188	1905	670,939	$2,243,010
1903	466,351	2,091,875	1906	857,013	2,753,551
1904	585,861	2,311,401	1907	979,652	3,206,793

The following table shows the value of the coal-tar products imported into the United States and the duty paid thereon in each year since 1896, inclusive:

Coal-tar products imported into the United States, 1896–1907.

Year.	Salicylic acid.		Alizarine and colors or dyes, natural and artificial.		Aniline salts.		Coal-tar colors or dyes, not specially provided for.	
	Value.	Duty.	Value.	Duty.	Value.	Duty.	Value.	Duty.
1896 [a]	$138,013	Free.	$994,395	Free.	$662,459	Free.	$2,918,333	$729,583
1897 [a]	201,980	Free.	1,023,425	Free.	812,884	Free.	3,163,182	790,796
1898 [a]	28,688	$6,794	886,349	Free.	1,087,704	Free.	3,723,288	1,098,532
1899 [a]	57,192	18,536	700,786	Free.	743,130	Free.	3,900,099	1,170,030
1900 [a]	89,175	24,069	771,336	Free.	537,812	Free.	4,792,103	1,437,631
1901	76,786	22,227	713,392	Free.	589,535	Free.	4,034,171	1,210,251
1902	57,852	21,913	1,028,327	Free.	631,467	Free.	4,911,668	1,473,500
1903	19,012	7,827	660,464	Free.	789,553	Free.	5,252,611	1,575,783
1904	7,305	3,276	636,418	Free.	686,184	Free.	4,903,077	1,470,923
1905	2,214	923	625,491	Free.	789,052	Free.	5,673,242	1,701,973
1906	2,772	991	661,155	Free.	806,901	Free.	5,717,932	1,715,380
1907	1,240	489	782,368	Free.	667,758	Free.	5,830,651	1,749,196

Year.	Coal tar, all preparations, not colors or dyes.		Coal-tar products not medicinal, not dyes, known as benzol, toluol, etc.		Total.	
	Value.	Duty.	Value.	Duty.	Value.	Duty.
1896 [a]	.....	.....	.....	.....	$4,713,200	$729,583
1897 [a]	.....	.....	.....	.....	5,201,471	790,796
1898 [a]	$134,416	$26,883	$228,037	Free.	6,088,482	1,132,209
1899 [a]	221,101	44,220	393,602	Free.	6,015,910	1,232,786
1900 [a]	274,946	54,989	397,780	Free.	6,863,152	1,516,689
1901	342,116	68,423	383,559	Free.	6,139,559	1,300,901
1902	496,928	99,386	368,098	Free.	7,494,340	1,594,799
1903	544,176	108,835	425,069	Free.	7,690,885	1,692,445
1904	522,242	104,448	391,645	Free.	7,146,871	1,578,647
1905	768,556	153,711	486,439	Free.	8,344,994	1,856,607
1906	864,067	172,814	483,416	Free.	8,536,243	1,889,185
1907	911,096	182,219	653,288	Free.	8,846,401	1,931,904

[a] Fiscal years.

PRODUCTION OF COKE, BY STATES.

ALABAMA.

For a quarter of a century, from 1880 to 1905, Alabama and West Virginia were close rivals for second place in the rank of coke-producing States, and during the last five years of that period each State held the place alternately. During the last three years West Virginia has outranked Alabama, and as in 1907 the production of West Virginia exceeded that of her rival by over 1,000,000 tons, or about 33⅓ per cent, it would appear that Alabama can no longer aspire to the honor. The effect of the monetary disturbances in October, 1907, was felt in Alabama more seriously than it was in West Virginia, and while West Virginia's production increased substantially, Alabama's fell off slightly, from 3,034,501 short tons in 1906 to 3,021,794 tons in 1907, a loss of 12,707 short tons. Owing, however, to the abnormally high price which prevailed during the first part of the year, the value of Alabama's coke product increased from $8,477,899 in 1906 to $9,216,194, a gain of $738,295, or 8.7 per cent.

The advantage possessed by Alabama's coke manufacturers over those in West Virginia is in the home market for the product, and this is shown by the fact that while West Virginia's coke, which is certainly of as good quality as that of Alabama, sold for an average of $2.36 per ton during 1907, Alabama's sold for an average of $3.05, and whereas West Virginia's production exceeded Alabama's by over 1,000,000 tons, the value of West Virginia's product exceeded that of Alabama's by only $500,000.

There were 43 coke-making establishments in Alabama in 1907, an increase of 1 over 1906. The total number of ovens increased from 9,731 in 1906 to 9,889 in 1907. The 43 establishments included 6 with a total of 715 ovens that were idle during 1907, as compared with the same number of establishments and 1,211 ovens idle in 1906. There were 50 new beehive ovens building at the close of 1907, against 160 at the close of 1906. There were 2 by-product recovery plants, with a total of 280 ovens, all of which were operated during 1907. The production of coke in Alabama in 1880, 1890, 1900, and from 1903 to 1907, is shown in the following table:

Statistics of the manufacture of coke in Alabama, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	4	316	100	106,283	60,781	$183,063	$3.01	57
1890	20	4,805	371	1,809,964	1,072,942	2,589,447	2.41	59
1900	30	6,529	690	3,582,547	2,110,837	5,629,423	2.67	58.9
1903	39	8,764	381	4,483,942	2,693,497	7,622,528	2.83	60
1904	42	9,059	440	3,996,578	2,340,219	5,716,413	2.44	58.6
1905	42	9,586	150	4,409,854	2,576,986	7,646,957	2.97	58.4
1906	42	9,731	160	5,184,597	3,034,501	8,477,899	2.79	58.5
1907	43	[a] 9,889	50	4,973,296	3,021,794	9,216,194	3.05	61

[a] Includes 280 Semet-Solvay ovens.

A considerable increase is noted in the quantity of coal washed before coking in 1907 as compared with 1906, and this is particularly noticeable in the quantity of slack coal used for coking. In 1906 the quantity of washed slack used was 1,759,837 short tons, while in

1907 the quantity of slack washed was 2,227,043 tons. The total quantity of washed coal, including mine run, was 3,924,956 tons, as compared with 3,569,926 tons in 1906. The unwashed coal in 1907 was 1,020,907 short tons of mine run and 27,433 tons of slack, as compared with 1,493,549 tons of mine run and 121,122 tons of slack in 1906.

Character of coal used in the manufacture of coke in Alabama, 1890–1907, in short tons.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	1,480,669	.....	206,106	123,189	1,809,964
1895	1,208,020	.....	32,068	1,219,377	2,459,465
1900	1,729,882	152,077	165,418	1,535,170	3,582,547
1903	1,359,450	602,446	.....	2,522,046	4,483,942
1904	670,271	922,864	741	2,402,702	3,996,578
1905	1,297,376	1,247,924	.....	1,864,554	4,409,854
1906	1,493,549	1,810,089	121,122	1,759,837	5,184,597
1907	1,020,907	1,697,913	27,433	2,227,043	4,973,296

COLORADO AND UTAH.

The statistics of the manufacture of coke in Colorado and Utah are combined in order not to divulge individual operations, there being but two establishments in Utah, both of which are owned by one company. The production of the two States in 1907 amounted to 1,421,579 short tons, valued at $4,747,436, against 1,455,905 short tons, valued at $4,504,748 in 1906, indicating a decrease of 34,326 short tons, or 2.36 per cent in quantity, and a gain in value of $242,688, or 5.39 per cent. The average price per ton advanced from $3.09 in 1906 to $3.34 in 1907.

One new establishment was completed in Colorado in 1907, increasing the total for the two States from 17 to 18, and the total number of ovens from 4,103 to 4,683 in 1907. One establishment of 23 ovens was idle both in 1906 and 1907.

The statistics of the manufacture of coke in Colorado and Utah in 1880, 1890, 1900, and for the last five years are shown in the following table:

Statistics of the manufacture of coke in Colorado and Utah, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	1	200	50	51,891	25,568	$145,226	$5.68	49
1890	8	916	30	407,023	245,756	959,246	3.90	60
1900	14	1,692	0	997,861	618,755	1,746,732	2.82	62
1903	18	3,959	0	1,776,974	1,053,840	3,089,783	2.93	59.3
1904	17	3,923	0	1,376,354	789,060	2,590,251	3.28	57.3
1905	17	3,925	150	2,368,365	1,378,824	4,157,517	3.02	58.2
1906	17	4,103	250	2,566,196	1,455,905	4,504,748	3.09	56.7
1907	18	4,683	50	2,388,911	1,421,579	4,747,436	3.34	59.5

For several years prior to 1906 practically all of the coal used in the manufacture of coke in Colorado and Utah was slack, a large proportion of which was washed before being charged into the ovens. In 1906 there were 708,306 tons of run-of-mine coal used, of which

703,440 tons were washed. In 1907 the run-of-mine coal used amounted to 679,182 tons, of which 676,226 tons were washed. The slack coal used in 1907 amounted to 1,709,729 tons, of which 654,540 tons were washed and 1,055,189 unwashed.

The character of the coal used in the manufacture of coke in Colorado and Utah in 1890, 1895, 1900, and from 1903 to 1907 is shown in the following table:

Character of coal used in the manufacture of coke in Colorado and Utah, 1890–1907.

Year.	Run-of-mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	36,058	0	395,023	0	431,081
1895	119,868	0	453,597	7,119	580,584
1900	229,311	0	316,527	452,023	997,861
1903	0	0	594,584	1,182,390	1,776,974
1904	400	0	745,450	630,504	1,376,354
1905	0	0	691,982	1,676,383	2,368,365
1906	4,866	703,440	1,065,353	792,537	2,566,196
1907	2,956	676,226	1,055,189	654,540	2,388,911

GEORGIA.

Dade County, in the extreme northwestern corner of Georgia, contains a small area of the Walden Ridge (Tennessee) coal basin, and a portion of the adjoining county of Walker is underlain by an extension of the Lookout Mountain beds of Alabama. Coal mining on quite an extensive scale is carried on in both counties, and a good grade of coke is made from the slack coal produced in mining. The iron furnaces in and near Chattanooga, Tenn., supply the principal market for the coke. All of the coal used in coking was washed before being charged into the ovens.

The coke production of Georgia in 1907 amounted to 74,934 short tons, valued at $315,371, against 70,280 short tons, valued at $277,921 in 1906, indicating an increase in quantity of 4,654 tons, or 6.62 per cent, and of $37,450 or 13.5 per cent in value. The average price per ton was advanced from $2.81 in 1904 to $3.18 in 1905, to $3.95 in 1906, and to $4.21 in 1907. There are only two establishments in the State, both of which have been in operation since 1900, though 50 ovens of one establishment were idle during November and December of 1907, following the depression in the iron trade.

The statistics of coke production in Georgia in 1880, 1890, 1900, and from 1903 to 1907 are shown in the following table:

Statistics of the manufacture of coke in Georgia, 1880–1907

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	1	140	40	63,402	38,041	$81,789	$2.15	60
1890	1	300	0	170,388	102,233	150,995	1.48	60
1900	2	480	0	140,988	73,928	210,646	2.85	52.4
1903	2	500	0	146,086	85,546	368,351	4.31	58.5
1904	2	500	0	132,270	75,812	212,697	2.81	57.3
1905	2	533	0	119,036	70,593	224,260	3.18	59.3
1906	2	531	0	128,052	70,280	277,921	3.95	54.9
1907	2	350	0	136,031	74,934	315,371	4.21	55.1

ILLINOIS.

The operations of the 160 Semet-Solvay ovens at South Chicago, mention of which was made in the report for 1906, have given Illinois some prominence as a coke-manufacturing State, although the coal used is drawn from the mines of Fayette County, West Virginia, and not from the mines of Illinois. In 1907 Illinois ranked tenth among the coke-producing States, with a total output of 372,697 short tons, valued at $1,737,464, against 268,693 short tons, valued at $1,205,462, in 1906, and 10,307 tons, valued at $27,681, in 1905. There was one other plant besides the Semet-Solvay ovens at South Chicago which produced coke in 1907. This was the Gallatin Coal and Coke Company at Equality, which made coke in Belgian ovens from Illinois coal. There were at the close of the year 280 Koppers regenerative by-product ovens under construction at Joliet by the Illinois Steel Company. It is anticipated that these ovens will be completed and in operation before the close of 1908.

The statistics of the manufacture of coke in Illinois during the last four years are shown in the following table:

Statistics of the manufacture of coke in Illinois, 1904–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1904	5	155	120	8,131	4,439	$9,933	$2.24	54.6
1905	5	275	0	16,821	10,307	27,681	2.685	61.3
1906	4	309	0	362,163	268,693	1,205,462	4.48	74.2
1907	5	[a] 309	[b] 280	514,983	372,697	1,737,464	4.66	72.3

[a] Includes 160 Semet-Solvay ovens. [b] Koppers regenerative by-product ovens.

KANSAS.

The coking industry of Kansas is of comparatively small importance and depends for its existence upon the limited demand of the zinc smelters, which do not require a high grade of coke. In fact, all of the coke made in the State is at ovens operated in connection with the zinc works, the coal being slack obtained from the mines in the vicinity of Pittsburg, and all of which is used unwashed. The plant of 50 ovens at Cokedale has not been in operation during the last four or five years. There were 6 establishments with a total of 83 ovens, all of which made coke in 1907, except the plant at Cokedale. One of the establishments consisting of 10 ovens made coke in the early part of the year but was abandoned in November. The production of the State, which had decreased steadily from 20,902 tons in 1902 until in 1906 it amounted to only 1,698 tons, increased to 6,274 tons in 1907.

The production in 1890, 1900, and since 1903 has been as follows:

Statistics of the manufacture of coke in Kansas, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke ot ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	2	6	0	4,800	3,070	$6,000	$1.95	64
1890	7	68	0	21,809	12,311	29,116	2.37	56
1900	9	91	0	10,303	5,948	14,985	2.52	57.7
1903	9	91	0	30,503	14,194	50,221	3.54	46.5
1904	6	91	0	14,525	9,460	23,485	2.48	65
1905	6	91	0	6,504	4,425	13,818	3.12	68
1906	5	81	0	2,807	1,698	4,101	2.42	60.5
1907	6	83	0	11,392	6,274	19,837	3.16	55

KENTUCKY.

Kentucky is the only one of the United States whose coal supplies are drawn from any two of the great fields. The eastern counties of the State are underlain by the coal measures of the Appalachian system, while the southern extremity of the Eastern Interior or Illinois-Indiana field is worked extensively in the western part of Kentucky. Coke is made from coal mined in both the eastern and the western parts of the State, and although the coals of the eastern counties are in large part included among the coking coals of the Appalachian field, and although little or no coke is made from the coals of the Eastern Interior field in Illinois or Indiana, more than half of Kentucky's coke output is made in the western part of the State.

There are 6 coking establishments in Kentucky, 4 of which made coke in 1906 and 1907, the same plants being idle in both years. The 2 idle plants consist of 54 ovens. One establishment of 200 ovens was idle during the greater part of the year, and the production decreased from 74,064 tons in 1906 to 67,068 tons in 1907. The value decreased from $169,846 in 1906 to $157,288 in 1907. The average price per ton advanced from $2.29 in 1906 to $2.35 in 1907.

The production of coke in Kentucky in 1880, 1890, 1900, and from 1903 to 1907 is shown in the following table:

Statistics of the manufacture of coke in Kentucky, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	5	45	0	7,206	4,250	$12,250	$2.88	59
1890	9	175	103	24,372	12,343	22,191	1.80	51
1900	5	458	3	190,268	95,532	235,505	2.47	50.2
1903	7	499	0	247,950	115,362	305,327	2.65	46.5
1904	7	499	0	140,139	64,112	138,226	2.15	45.7
1905	6	495	0	154,783	79,487	159,659	2.01	51.4
1906	6	462	0	148,448	74,064	169,846	2.29	49.9
1907	6	495	0	129,538	67,068	157,288	2.35	51.7

MISSOURI.

Coke making in Missouri has never been much of an industry, and, as in Kansas, has been limited to the coking of a small quantity of Pittsburg (Kansas) slack, the coke being used at the zinc smelters in connection with which the ovens were operated. One of the two small plants with which the State has been credited during the last five years was abandoned in 1907, and the other one was idle in 1906 and 1907.

The statistics of production for a series of years has been as follows:

Statistics of the manufacture of coke in Missouri, 1887–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1887	1	4	0	5,400	2,970	$10,395	$3.50	55
1890	3	10	0	9,491	6,136	9,240	1.51	65
1900	3	10	0	3,775	2,087	5,268	2.52	55.3
1903	2	8	0	3,004	1,839	5,797	3.15	61.2
1904	2	8	0	3,815	2,446	6,115	2.50	64
1905	2	6	0	2,551	1,580	4,072	2.58	61.9
1906	2	6	0	0	0	0	0	0
1907	1	5	0	0	0	0	0	0

MONTANA.

One new establishment was added to the coke-manufacturing plants of Montana in 1907, increasing the number from 4 to 5. There was, however, no production at the new establishment, not being entirely completed before the end of the year, and two of the other plants, with a total of 100 ovens each, were also idle throughout the year. The entire production amounted to 40,714 tons, valued at $295,174, an increase of 2,532 tons in quantity and $29,150 in value over the production of 1906, when it amounted to 38,182 tons valued at $266,024. The average price per ton advanced from $6.97 in 1906 to $7.25 in 1907. A considerable advance is noted in the percentage yield of coal in coke in 1906 and 1907, while the yield reported in 1905 was low as compared with the two preceding years. The low percentage in 1905 was probably due to the fact that in that year the weight of the coal used was given before washing, while in other years the weight of the washed coal is reported. The higher yield in 1907, as compared with 1906, indicates a better separation of the impurities by washing. The quantity of coal used in 1907 was less than that used in 1904, while the production of coke was greater. All of the coal used for coke making in Montana is mine run, and nearly all of this is washed before being charged into the ovens.

The statistics of the manufacture of coke in Montana in 1884, when production was first reported, and for the years 1890, 1900, and since 1903 have been as follows:

Statistics of the manufacture of coke in Montana, 1884–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1884	3	5	12	165	75	$900	$12.00	46
1890	2	140	0	32,148	14,427	125,655	8.71	45
1900	3	342	111	108,710	54,731	337,079	6.16	50.3
1903	4	555	0	82,118	45,107	310,882	6.89	54.9
1904	4	520	0	78,303	41,497	280,745	6.77	53
1905	4	555	100	68,777	31,482	211,351	6.71	45.8
1906	4	555	100	69,045	38,182	266,024	6.97	55.3
1907	5	567	15	68,948	40,714	295,174	7.25	59

NEW MEXICO.

New Mexico is assuming considerable importance as a coke producer, the advance made during the last three years being particularly noticeable. In 1903 there were only 2 establishments in the Territory with a total of 126 ovens, and the production in that year amounted to 11,050 tons. In 1904 the number of establishments had increased to 3 with a total of 234 ovens, and the production amounted to 58,259 tons. In 1905 the same number of establishments reported 258 ovens completed, with 498 building, and the production amounted to 89,638 tons. In 1906, 4 establishments with a total of 571 completed ovens and 450 building produced 147,747 tons. Three hundred and twenty-five of the ovens building in 1906 were completed in 1907, increasing the total number of completed ovens to 896, and the production of coke increased to 265,125 tons. This increase in 1907 advances the Territory from sixteenth to fifteenth place in the rank of coke-producing States and Territories, and gave

New Mexico the largest percentage of increase of any State or Territory during 1907 over 1906 with the exception of Kansas. In the latter State the production was insignificant in either year. The increase of New Mexico's coke production in 1907 over 1906 was 117,378 tons or 79.45 per cent in quantity, and $397,541 or 89.8 per cent in value. The average price per ton increased from $3 in 1906 to $3.17 in 1907. One of the establishments in the Territory, having a bank of 50 ovens, was idle during 1907. With the exception of 2,498 tons, all of the coal used in the coke ovens of New Mexico in 1907 was washed slack.

The statistics of production in 1882, 1890, 1900, and from 1903 to 1907 are shown in the following table:

Statistics of the manufacture of coke in New Mexico, 1882–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton	Yield of coal in coke (per cent).
		Built.	Building.					
1882	2	0	12	1,500	1,000	$6,000	$6.00	66
1890	2	70	0	3,980	2,050	10,025	4.89	51.5
1900	2	126	0	74,261	44,774	130,251	2.91	60.3
1903	2	126	0	18,613	11,050	31,539	2.85	59.4
1904	3	234	0	94,397	58,259	171,976	2.95	61.7
1905	3	258	498	148,469	89,638	253,229	2.83	60.4
1906	4	571	450	261,609	147,747	442,712	3.00	56.5
1907	4	896	125	446,140	265,125	840,253	3.17	59.4

OHIO.

Although Ohio ranks fourth in importance among the coal-producing States, it has not developed much prominence as a coke producer. This is in part due to the fact that much of the coal mined in the State makes an excellent blast-furnace fuel in its raw state and also to the proximity of the higher grade coking coals of Pennsylvania and West Virginia. The operations of the Rothberg by-product recovery plant at Cleveland, which was in full blast in 1905, 1906, and 1907, and the Otto-Hoffmann plant at Hamilton (near Cincinnati), together with an increased production of beehive coke at Leetonia, has, however, brought the total production for the State during the last three years up to considerable importance, although the quantity produced in 1907 was less than that reported in 1906.

The production in 1907 amounted to 270,634 short tons, valued at $819,262, as compared with 293,994 tons valued at $1,013,248 in 1906. The Otto-Hoffmann plant at Hamilton was not in operation from July 6 to December 10, owing to damages occasioned by a storm, and to this fact was probably due the slight falling off in the production for 1907. To Ohio is given the distinction of being the only State in which there was a decline in the average price of coke in 1907 as compared with 1906. The average price declined from $3.45 in 1906 to $3.03 in 1907. Of the 8 establishments in the State, one, with 120 ovens, was idle in 1907. This plant has been idle for the last three years.

The statistics of the production of coke in Ohio in 1880, 1890, 1900, and for the last five years are shown in the following table:

Statistics of the manufacture of coke in Ohio, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	15	616	25	172,453	100,596	$255,905	$2.54	58
1890	13	443	1	126,921	74,633	218,090	2.92	59
1900	8	369	50	115,269	72,116	194,042	2.69	62.5
1903	8	440	[a] 66	211,473	143,913	528,142	3.67	68
1904	8	539	[a] 14	165,487	109,284	337,606	3.09	66
1905	8	573	0	396,961	277,130	970,897	3.50	69.8
1906	8	575	0	437,567	293,994	1,013,248	3.45	67.2
1907	8	[a] 600	[b] 50	376,759	270,634	819,262	3.03	71.8

[a] Includes 105 Rothberg and 50 United Otto ovens. [b] United Otto ovens.

The larger part of the coal used in coke making in Ohio is unwashed run of mine, though in 1907 there was a larger proportion of washed coal used than in previous years. The Otto-Hoffmann plant at Hamilton, which formerly used run of mine unwashed coal, reported washing the coal before coking in 1907. Of the slack coal used in 1907 36,514 tons were unwashed and 25,896 tons washed. The washing of the run of mine coal at Hamilton is probably partly responsible for the increased yield of coal in coke, the percentage yield having increased from 67.2 in 1906 to 71.8 in 1907.

The character of the coal used in the manufacture of coke in Ohio in 1890, 1895, 1900, and from 1903 to 1907 is shown in the following table:

Character of coal used in the manufacture of coke in Ohio since 1890, in short tons.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	34,729	0	54,473	37,719	126,921
1895	28,053	0	10,868	13,000	51,921
1900	68,175	0	17,094	30,000	115,269
1903	174,544	0	9,216	27,713	211,473
1904	140,915	0	7,249	17,323	165,487
1905	348,502	0	10,837	37,622	396,961
1906	356,540	0	38,737	42,290	437,567
1907	268,637	45,712	36,514	25,896	376,759

OKLAHOMA.

Coke making in Oklahoma (Indian Territory) showed a decided falling off in 1907 as compared with 1906, and in 1906 the output was less than in 1905. The production for the last three years has been, respectively—1905, 54,781 tons; 1906, 49,782 tons; 1907, 19,089 tons. The decrease in the coke production was due principally to the extraordinary demand for coal which prevailed during 1907, the ovens being operated chiefly to utilize the slack used in the coal mining operations, and on account of the unusual demand for coal of all kinds in 1907 there was less surplus slack for coke making.

There are 5 coke making establishments in the State, of which three were operated in 1907. The 100 ovens at Howe have not been in operation for several years, and the 50 ovens at Alderson were also idle in 1907. In sympathy with the demand at advanced prices for coal in 1907, the average price for coke rose to $4.32 from $4.10 in 1906.

The statistics of the manufacture of coke in Oklahoma (Indian Territory) in 1880, 1890, 1900, and during the last 5 years are shown in the following table:

Statistics of the manufacture of coke in Oklahoma (Indian Territory) 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	1	20	0	2,494	1,546	$4,638	$3.00	62
1890	1	80	0	13,278	6,639	21,577	3.25	50
1900	3	230	0	79,534	38,141	152,204	3.99	48
1903	5	286	0	110,088	49,818	227,542	4.57	45
1904	5	286	0	98,847	44,808	209,165	4.67	45.3
1905	5	388	50	123,389	54,781	199,424	3.64	44.4
1906	5	490	0	95,296	49,782	204,205	4.10	52.2
1907	5	490	50	38,615	19,089	82,447	4.32	49.4

All of the ovens in Oklahoma are of the standard beehive type and, as stated, are constructed for the purpose of utilizing slack coal produced in the mining operations, and for which there is usually little or no demand. In 1906, when the demand for coal was comparatively light, more than half the coal used in coke making was run of mine unwashed, while in 1907, with the heavier demand for coal, no run of mine was used for coke making, and all of the slack coal used was reported as washed.

The character of the coal used in the manufacture of coke in 1890, 1900, and since 1903 has been as follows:

Character of coal used in the manufacture of coke in Oklahoma (Indian Territory) 1890–1907, in short tons.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	0	0	0	13,278	13,278
1900	0	0	20,832	58,702	79,534
1903	331	0	1,295	108,462	110,088
1904	0	0	59,760	39,087	98,847
1905	21,891	0	49,407	52,091	123,389
1906	50,802	0	0	44,494	95,296
1907	0	0	38,615	0	38,615

PENNSYLVANIA.

Pennsylvania in the manufacture of coke, as in the mining of coal, far outranks the other States, and for more than a quarter of a century has contributed over 50 per cent of the total coke product of the United States. In 1907 Pennsylvania produced 65.02 per cent of the total coke output of the United States. Until the last year from 55 to 60 per cent of the total coke production of the State has come from the famous Connellsville district, contained in Fayette and Westmoreland counties, but in 1907 the percentage of this district to the total for the State was a little less than 50. This was not due to any falling off in the Connellsville district, but rather to an increased production in some of the other districts, particularly the Lower Connellsville or Klondike district. The Lower Connellsville district is located in Fayette County, and is separated from the Connellsville Basin proper

by the Greensburg anticline. The Upper Connellsville or Latrobe district is the northern extremity of the Connellsville trough or basin.

If to the production of the Connellsville district proper is added that of the Upper and Lower Connellsville districts, the combined output represents 77.06 per cent of the total production of the State, and 50.1 per cent of the total output in the United States.

The quantity of coke produced in Pennsylvania in 1907 was 26,513,214 short tons, out of a total for the United States of 40,779,564 tons. In 1906 Pennsylvania produced 23,060,511 short tons out of a total of 36,401,217 short tons; in 1905 this State contributed 20,573,736 tons out of a total of 32,231,129 tons. Out of these totals the Connellsville district produced in 1907 13,089,427 tons, in 1906 12,057,840 tons, and in 1905 11,365,077 tons. Including the Lower and Upper Connellsville districts, the production for this entire region for these years was, respectively, 20,430,587 tons in 1907, 18,257,204 tons in 1906, and 15,992,333 in 1905. Compared with 1906 the total production of Pennsylvania in 1907 showed an increase of 3,452,703 tons, or 14.97 per cent. In the report for 1906 it was stated that that year was the most satisfactory in the history of the Pennsylvania coke trade, but in this respect 1907 showed an improvement over the preceding year. The production in 1907 was the largest ever made, and prices were still further advanced over those of 1906, which had been the highest in recent years with the exception of 1903, when, because of the coal shortage due to the strike in the anthracite region, coke prices were abnormally advanced. In 1907, with no such abnormal conditions, the average price of coke made in Pennsylvania exceeded that of the record made in 1903. There was scarcely a time during 1907, until the effects of the financial troubles were felt, that the production was in excess of the demand. There was hardly even any of the usual summer idleness, and, as transportation facilities showed also an improvement over 1906 and the immediately preceding years, operators were able to market their product without serious delay from lack of car supply or other deficiencies in transportation.

The total value of the coke product of Pennsylvania in 1907 was $67,638,024, against $54,184,531 in 1906, showing a gain of $13,453,493, or 24.83 per cent, as compared with the increase of 14.97 per cent in tonnage. The increase in value of 1907 over 1906 was more than 50 per cent of the total value of the coke produced in Pennsylvania in 1904, only three years before.

The average price obtained for coke made in Pennsylvania in 1907 was $2.55 as compared with $2.35 in 1906 and $2.05 in 1905. The price in 1907 was the highest reported in recent years. The percentage yield of coal in coke was 66.7 as compared with 66.8 in 1906, and while the percentage was less in 1907 than in 1906, it was above the average for recent years.

The quantity of coal consumed in the manufacture of coke in Pennsylvania in 1907 was 39,733,177 short tons, valued at $42,732,546 and represented 26.4 per cent of the total production of bituminous coal in the State during the year. In 1906 the consumption of coal for coke making was 34,503,513 short tons (26.7 per cent of the State's total bituminous coal product), valued at $35,395,374. The difference between the value of the coke and the coal from which it was made in 1907 was $24,905,478, or 58.3 per cent, while in 1906 the difference was $18,789,157, or 53 per cent. In 1905 the difference between the value of the coke and the value of the coal was $12,516,374,

or 42 per cent. Coke prices were low in 1904, particularly as compared with the price of coal, and the difference in that year was only $3,568,206, or 16.6 per cent. In 1903, on the other hand, when coke prices were abnormally inflated by the scarcity of anthracite fuel, the difference between the coal and the coke values was nearly 60 per cent.

The number of coke-making establishments increased from 239 to 253, and the number of completed ovens increased from 47,185 to 51,364, a gain of 4,179. There were 1,337 ovens building at the close of 1907, as compared with 2,373 at the end of 1906. The completed ovens included 405 Semet-Solvay and 934 United Otto by-product recovery ovens, a total of 1,339 against a total of 1,232 by-product ovens in 1906.

The statistics of the production of coke in Pennsylvania for the years 1880, 1890, 1900, and for the last five years are shown in the following table:

Statistics of the manufacture of coke in Pennsylvania, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	124	9,501	836	4,347,558	2,821,384	$5,255,040	$1.86	65
1890	106	23,430	74	13,046,143	8,560,245	16,333,674	1.91	65.6
1900	177	32,548	2,310	20,239,966	13,357,295	29,692,258	2.22	66
1903	212	40,239	1,785	23,724,207	15,650,932	38,969,101	2.49	65.9
1904	217	42,165	1,621	22,432,064	14,861,064	25,027,462	1.68	66.2
1905	226	42,608	2,384	31,030,345	20,573,736	42,253,178	2.05	66.3
1906	239	47,185	2,373	34,503,513	23,060,511	54,184,531	2.35	66.8
1907	253	[a]51,364	1,337	39,733,177	26,513,214	67,638,024	2.55	66.7

[a] Includes 934 United Otto and 405 Semet-Solvay ovens.

The character of the coal used in the manufacture of coke in Pennsylvania in 1890, 1895, 1900, and from 1903 to 1907 has been as follows:

Character of the coal used in the manufacture of coke in Pennsylvania since 1890, in short tons.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	11,788,625	303,591	630,195	323,732	13,046,143
1895	13,618,376	34,728	440,869	117,594	14,211,567
1900	17,692,623	647,045	1,300,796	599,502	20,239,966
1903	20,297,033	644,441	1,981,544	801,189	23,724,207
1904	19,447,395	697,771	1,340,474	946,424	22,432,064
1905	26,148,696	1,335,631	2,436,621	1,109,397	31,030,345
1906	27,471,566	3,972,712	1,584,152	1,475,083	34,503,513
1907	33,589,751	2,267,142	2,566,090	1,310,194	39,733,177

PRODUCTION BY DISTRICTS.

In previous chapters of this series it has been customary to consider the production of coke in Pennsylvania according to certain well-defined districts. These divisions are based to some extent upon geographic boundaries, but also upon the quality of the coal mined and the coke produced. Each one has been more fully described in some of the preceding volumes, but the following brief statement regarding the territory included in the different coking districts is repeated here for the sake of convenience.

The Allegheny Mountain district includes the ovens along the line of the Pennsylvania Railroad from Gallitzin eastward over the crest of the Alleghenies to beyond Altoona. The Allegheny Valley district formerly included the coke works of Armstrong and Butler counties and one of those in Clarion County, the other ovens in the latter county being included in the Reynoldsville-Walston district. All but two of the Allegheny Valley plants have been abandoned, and the production of these establishments has for the last few years been included in that of the Pittsburg district. What was previously known as the Beaver district included the ovens in Beaver and Mercer counties, but all the ovens in Beaver County have been abandoned, and the operations of the Semet-Solvay ovens in Mercer County are also now included in the Pittsburg district. The Blossburg and Broadtop districts embrace the Blossburg and Broadtop coal fields. The ovens of the Clearfield-Center district are chiefly in the two counties from which it derives its name. A few ovens constructed recently in Elk County have been included in the Clearfield-Center district. The Connellsville district is the well-known region of western Pennsylvania in Westmoreland and Fayette counties, extending from just south of Latrobe to Fairchance. The Lower Connellsville region is entirely in Fayette County and southwest of the Connellsville basin proper, from which it is separated by the Greensburg anticline. It embraces the recent developments in the vicinity of Uniontown, and is now the second producing district of the State. The Greensburg, Irwin, Pittsburg, and Reynoldsville-Walston districts include the ovens near the towns which have given the names to these districts. The Upper Connellsville district, sometimes called the Latrobe district, is near the town of Latrobe. The Semet-Solvay ovens at Chester, Steelton, and Lebanon, and the United Otto ovens at Lebanon are in what has been designated as the Lebanon-Schuylkill district, the production of which has been combined with that of the Broadtop district.

The statistics of the manufacture of coke in Pennsylvania by districts, in 1906 and 1907, are presented in the following tables:

Coke production in Pennsylvania in 1906 and 1907, by districts.

1906.

District.	Establishments.	Ovens. Built.	Ovens. Building.	Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke per ton.	Yield of coal in coke (per cent).
Allegheny Mountain.	16	[a] 2,137	[b] 137	1,271,710	893,271	$2,552,967	$2.85	70.2
Allegheny Valley [c]	2	50	0					
Broadtop [d]	5	584	0	978,893	710,143	2,824,343	3.98	72.5
Clearfield-Center	7	738	0	91,822	56,634	162,722	2.87	61.6
Connellsville	101	[e] 23,616	142	17,956,160	12,057,840	26,858,660	2.23	67.1
Greensburg	8	1,428	260	1,118,227	678,817	1,641,473	2.42	60.7
Irwin	5	581	0	348,007	230,552	510,572	2.21	66.2
Lebanon and Schuylkill [d]	4	[f] 507	0	(d)	(d)	(d)	(d)	(d)
Lower Connellsville	53	9,708	1,502	7,465,205	5,188,135	12,046,889	2.32	69.4
Pittsburg [g]	8	[h] 2,818	0	2,376,403	1,463,795	3,620,030	2.47	61.5
Reynoldsville-Walston	8	2,502	0	1,399,801	770,095	1,794,127	2.33	55.8
Upper Connellsville	22	2,516	332	1,497,285	1,011,229	2,172,748	2.15	67.5
Total	239	47,185	2,373	34,503,513	23,060,511	54,184,531	2.35	66.8

[a] Includes 260 Otto-Hoffmann ovens.
[b] Includes 112 Otto-Hoffmann ovens.
[c] Production included in Pittsburg district.
[d] Production in Lebanon and Schuylkill valleys included in Broadtop district.
[e] Includes 110 Semet-Solvay ovens.
[f] Includes 275 Semet-Solvay and 232 Otto-Hoffmann ovens.
[g] Includes production of ovens in Allegheny Valley district.
[h] Includes 330 Otto-Hoffmann and 25 Semet-Solvay ovens.

Coke production in Pennsylvania in 1906 and 1907, by districts—Continued.

1907.

District.	Establishments.	Ovens. Built.	Ovens. Building.	Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke per ton.	Yield of coal in coke (per cent).
Allegheny Mountain.	17	[a] 2,424	0	1,753,002	1,209,592	$3,564,117	$2.95	69
Allegheny Valley [b]	2	50	0					
Broadtop [c]	6	634	46	1,547,741	1,154,874	4,977,142	4.31	74.6
Clearfield-Center	7	706	0	115,388	74,187	191,378	2.58	64.3
Connellsville	101	[d] 23,857	0	19,751,739	13,089,427	30,355,050	2.32	66.3
Greensburg	8	1,735	0	1,206,981	798,003	2,273,078	2.85	66.1
Irwin	5	572	0	315,601	210,393	492,304	2.34	66.7
Lebanon and Schuylkill [c]	4	[e] 482	0					
Lower Connellsville	62	12,264	1,068	9,150,693	6,310,900	15,758,049	2.50	69
Pittsburg [f]	10	[g] 3,135	0	2,807,931	1,764,747	5,183,156	2.94	62.9
Reynoldsville-Walston	9	2,781	0	1,526,123	870,831	2,386,678	2.74	57.1
Upper Connellsville	22	2,724	223	1,557,978	1,030,260	2,457,072	2.38	66.1
Total	253	51,364	1,337	39,733,177	26,513,214	67,638,024	2.55	66.7

[a] Includes 372 United Otto and 152 Newton-Chambers ovens.
[b] Production included in Pittsburg district.
[c] Production of Lebanon and Schuylkill valleys included in Broadtop district.
[d] Includes 110 Semet-Solvay ovens.
[e] Includes 250 Semet-Solvay and 232 United Otto ovens.
[f] Includes production of ovens in Allegheny Valley district.
[g] Includes 330 United Otto and 25 Semet-Solvay ovens.

Allegheny Mountain district.—This district includes all of the coke ovens in the vicinity of Johnstown, Cambria County, and those lying along the line of the Pennsylvania Railroad in Indiana County. It also includes a few establishments in Somerset County. The plants in Cambria County include the Otto-Hoffmann by-product ovens at Johnstown, which are operated in connection with the iron and steel works of the Cambria Steel Company. This plant consisted originally of 60 ovens, built in 1895, since which time it has been three times enlarged—first, by 100 more ovens in March, 1899; the second enlargement, this time also of 100 ovens, was made in September, 1904, and the last, of 112 ovens, completed in February, 1907. The effects of this increased equipment is shown particularly by the gain in production of coke in this district in 1907, the output having increased from 893,271 short tons in 1906 to 1,209,592 short tons in 1907, a gain of 316,321 tons, or 35.4 per cent. The value of the product increased from $2,552,967 in 1906 to $3,564,117 in 1907, a gain of $1,011,150, or 39.6 per cent. The average price per ton, which increased from $2.09 in 1904 to $2.50 in 1905, and again to $2.85 in 1906, showed a further increase to $2.95 in 1907. There are 17 coke-making establishments in the district, with a total of 2,424 ovens, of which 2 establishments, with a total of 155 ovens, were idle throughout 1907.

The statistics of the manufacture of coke in the Allegheny Mountain district in 1880, 1890, 1900, and from 1903 to 1907 have been as follows:

Statistics of the manufacture of coke in the Allegheny Mountain district of Pennsylvania, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	8	291	0	201,345	127,525	$289,929	$2.27	63
1890	16	1,171	0	633,974	402,514	730,048	1.81	63.5
1900	14	1,341	0	876,440	557,184	1,260,441	2.26	63.6
1903	16	[a] 2,047	[b] 100	1,116,345	739,263	2,139,569	2.89	66.2
1904	17	[c] 2,153	100	785,105	551,570	1,152,101	2.09	70.3
1905	17	[c] 2,245	[d] 142	1,406,540	967,042	2,421,799	2.50	68.7
1906	16	[c] 2,137	[d] 137	1,271,710	893,271	2,552,967	2.85	70.2
1907	17	[e] 2,424	0	1,753,002	1,209,592	3,564,117	2.95	69

[a] Includes 160 Otto-Hoffmann ovens.
[b] Otto-Hoffmann ovens.
[c] Includes 260 Otto-Hoffmann ovens.
[d] Includes 112 Otto-Hoffmann ovens.
[e] Includes 372 United Otto and 152 Newton-Chambers ovens.

Broadtop district.—The Broadtop district includes the ovens in Bedford and Huntingdon counties, the coal for which is drawn from the Broadtop coal field. The number of establishments in this district was increased from 5 to 6 during 1907. All of the ovens were operated during 1907. There were 50 new ovens added to the district during 1907, increasing the total number from 584 to 634, and there were 46 ovens building at the close of 1907. The Semet-Solvay ovens at Lebanon, Chester, and Steelton, and the Otto-Hoffmann ovens at Lebanon, have been added to this district. This addition is responsible for the apparently large increase from 237,639 tons in 1904 to 483,198 tons in 1905; also for the larger increase from 710,143 tons in 1906 to 1,154,874 tons in 1907, a gain of 444,731 tons, or 62.6 per cent, with an increase in value from $2,824,343 to $4,977,142, a gain of $2,152,799, or 76.2 per cent. What has been stated in preceding pages regarding the high value of coke produced at by-product ovens is exemplified in the statistics in the following table, the large production of by-product coke making the total value for the Broadtop district $4.31 per ton, against $3.98 in 1906 and $3.20 in 1905. The highest price for coke obtained in any other district of Pennsylvania in 1907 was in the Allegheny Mountain district, where an average of $2.95 was obtained.

The statistics of the manufacture of coke in the Broadtop district, including the output of the by-product ovens at Lebanon, Chester, and Steelton, are shown in the following table:

Statistics of the manufacture of coke in the Broadtop district, Pennsylvania, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	5	188	105	92,894	51,130	$123,748	$2.40	55
1890	5	482	16	247,823	157,208	314,416	2.00	63
1900	5	532	0	179,088	113,448	230,580	2.03	63.
1903 [a]	5	571	0	351,507	244,898	748,920	3.06	69.6
1904 [b]	5	606	0	358,807	237,639	645,045	2.71	66.2
1905 [a]	5	614	0	687,954	483,198	1,544,966	3.20	70.2
1906 [a]	5	584	0	978,893	710,143	2,824,343	3.98	72.5
1907 [c]	6	634	46	1,547,741	1,154,874	4,977,142	4.31	74.6

[a] Includes production and value of coke in by-product ovens at Lebanon.
[b] Includes production and value of coke in by-product ovens at Lebanon and Chester.
[c] Includes production and value of coke in by-product ovens at Steelton, Lebanon, and Chester.

Clearfield-Center-Elk district.—This district, as its name implies, includes ovens located in the three counties mentioned, i. e., Clearfield, Center, and Elk. The district is not of much importance, and while, owing to the unusual demand for coke, the production of 1907 exceeded that of 1906, the coking industry in the district is showing a declining tendency. The total number of establishments in the district is 7, with a total of 706 ovens. Of these 7 establishments, 2, with a total of 200 ovens, were idle during 1907, and 1 plant with 200 ovens made less than 4,000 tons of coke, and another of 106 ovens made only a little more than 1 ton per oven during 1907.

The statistics of production for the years 1880, 1890, 1900, and from 1903 to 1907 have been as follows:

Statistics of the manufacture of coke in the Clearfield-Center-Elk district, Pennsylvania, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	1	0	0	200	100	$200	$2.00	50
1890	7	701	0	331,104	212,286	391,957	1.85	64
1900	7	568	0	212,196	134,828	283,592	2.10	63.5
1903	9	850	0	278,329	178,276	583,906	3.28	64
1904	9	828	0	61,564	35,931	79,746	2.22	58.4
1905	8	648	0	182,659	119,651	273,028	2.28	65.5
1906	7	738	0	91,822	56,634	162,722	2.87	61.6
1907	7	706	0	115,388	74,187	191,378	2.58	64.3

Connellsville district.—The Connellsville district of Pennsylvania is the largest coke-producing district in the world. The coal basin occupies a comparatively narrow synclinal trough, extending in a northeast-southwest direction nearly across the two counties of Fayette and Westmoreland, within the boundaries of which it is entirely contained. It lies a short distance east of the city of Pittsburg, and supplies the larger part of the fuel consumed in the iron and steel furnaces of Pittsburg and vicinity, the greatest iron-manufacturing center of the world. This district, until 1903, produced from 40 to 50 per cent of the total coke output of the United States, the smaller percentage during the last four years being due to the largely increased production from the Lower Connellsville or Klondike region, which lies entirely within Fayette County, and which is separated from the Connellsville basin proper by the Greensburg anticline. If to the Connellsville production is added that of the Lower Connellsville, the supremacy of the district has been more than maintained.

Connellsville coal is the ideal fuel for coking in beehive ovens, and it is probably to the success of the beehive practice in the Connellsville district that is due the prevalence of the beehive oven in coke manufacturing in the United States, manufacturers being lead by the idea that because beehive coke manufactured from Connellsville coal is the standard for furnace and foundry use, other coal should also be coked in beehive ovens, whereas many coals are found to give more satisfactory results in retort ovens. All but 110 of the 23,857 ovens in the Connellsville district at the close of 1907 were of the beehive type. The exception was a bank of Semet-Solvay ovens at Dunbar. Connellsville beehive coke is considered by some iron masters as

without rival for blast furnace use, and is undoubtedly the standard by which all other blast furnace cokes are judged.

The production of coke in the Connellsville district during 1907 amounted to 13,089,427 short tons, valued at $30,355,050, against 12,057,840 short tons, valued at $26,858,660 in 1906, a gain in 1907 of 1,031,587 tons, or 8.6 per cent in quantity, and of $3,496,390, or 13.02 per cent in value. The combined production of the Connellsville and Lower Connellsville districts in 1907 amounted to 19,400,000 tons, an increase of about 2,200,000 tons over the preceding year. The average price for Connellsville coke for 1907 was $2.32, as against $2.23 in 1906 and $1.96 in 1905. The number of establishments in the Connellsville district in 1907 was the same as in 1906—101—but the number of ovens increased from 23,616 to 23,857. There were no ovens reported as building in this district at the close of 1907. Of the total number of establishments, 4 with a total of 191 ovens were idle throughout 1907.

In the following table are presented the statistics of the manufacture of coke in the Connellsville district in 1880, 1890, 1900, and from 1903 to 1907:

Statistics of the manufacture of coke in the Connellsville region, Pennsylvania, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	67	7,211	731	3,367,856	2,205,946	$3,948,643	$1.79	65.5
1890	28	15,865	30	9,748,449	6,464,156	11,537,370	1.94	66.3
1900	98	[a] 20,981	686	14,946,659	10,020,907	22,383,432	2.23	67
1903	99	[b] 22,503	[c] 130	13,498,859	9,102,391	20,707,442	2.27	67.4
1904	101	[d] 22,695	1,044	13,185,690	8,883,220	13,990,329	1.58	67.4
1905	100	[d] 22,033	200	16,980,341	11,365,077	22,315,361	1.96	66.9
1906	101	[d] 23,616	142	17,956,160	12,057,840	26,858,660	2.23	67.1
1907	101	[d] 23,857	0	19,751,739	13,089,427	30,355,050	2.32	66.3

[a] Includes 50 Semet-Solvay by-product ovens.
[b] Includes 80 Semet-Solvay by-product ovens.
[c] Includes 30 Semet-Solvay by-product ovens.
[d] Includes 110 Semet-Solvay by-product ovens.

The following table, compiled by the Connellsville Courier, of Connellsville, Pa., shows the shipments of coke from the Connellsville region in 1906 and 1907, by months, in cars and tons, with the average number of cars shipped each working day in the month. These figures include coke made in the Upper and Lower Connellsville districts as well as in the Connellsville district proper. It will be noted that while in 1906 the production as given by the Courier was somewhat larger than that reported to the Geological Survey, the Survey's figures in 1907 are somewhat in excess of those reported by the Courier. According to the following table the shipments of coke from the Connellsville district (including the Upper and Lower Connellsville districts) was 19,029,058 short tons, while the production for these districts as reported to the Survey was 20,430,587 tons.

Shipments of coke from the Connellsville region, including Upper and Lower Connellsville districts, in 1906 and 1907, by months.

Month.	1906.			1907.		
	Cars.	Daily average.	Short tons.	Cars.	Daily average.	Short tons.
January	62,049	2,386	1,665,747	62,240	2,305	1,698,475
February	53,398	2,225	1,435,452	59,272	2,470	1,625,783
March	62,694	2,334	1,683,212	61,999	2,384	1,701,342
April	59,922	2,397	1,604,906	62,585	2,407	1,708,590
May	64,923	2,404	1,739,743	65,929	2,442	1,787,611
June	61,673	2,372	1,654,209	61,518	2,461	1,677,488
July	61,995	2,384	1,662,545	63,577	2,355	1,741,612
August	62,948	2,331	1,685,036	65,262	2,417	1,787,190
September	60,157	2,406	1,610,509	59,637	2,386	1,650,207
October	68,940	2,516	1,850,450	64,656	2,395	1,805,307
November	65,194	2,507	1,752,234	41,412	1,593	1,167,796
December	61,381	2,361	1,655,283	23,670	910	677,657
Total	745,274	2,385	19,999,326	691,757	2,210	19,029,058

The monthly shipments of coke from this region in the years 1903 to 1907, as reported by the Courier, are given in the following table:

Monthly shipments of coke from the Connellsville region, 1903–1907, in short tons.

Month.	1903.	1904.	1905.	1906.	1907.
January	1,134,272	718,382	1,283,152	1,665,747	1,698,475
February	958,984	845,428	1,350,128	1,435,452	1,625,783
March	1,274,863	1,062,192	1,497,756	1,683,212	1,701,342
April	1,346,053	1,118,043	1,843,502	1,604,906	1,708,590
May	1,288,550	1,146,907	1,451,554	1,739,743	1,787,611
June	1,379,257	945,520	1,354,470	1,654,209	1,677,488
July	1,327,239	887,402	1,622,998	1,662,545	1,741,612
August	1,211,826	975,724	1,328,002	1,685,036	1,787,190
September	1,239,265	1,153,471	1,726,734	1,610,509	1,650,207
October	1,041,966	1,148,089	1,430,238	1,850,450	1,805,307
November	629,768	1,207,131	1,488,942	1,752,234	1,167,796
December	513,187	1,219,174	1,519,050	1,655,283	677,657
Total	13,345,230	12,427,463	17,896,526	19,999,326	19,029,058

The total shipments, in cars, for the last twenty years were as follows:

Total and daily average shipments, in cars, 1888–1907.

Year.	Daily average.	Total cars.	Year.	Daily average.	Total cars.	Year.	Daily average.	Total cars.
1888	905	282,441	1895	1,410	441,243	1902	1,986	624,198
1889	1,046	326,220	1896	920	289,137	1903	1,782	558,738
1890	1,147	355,070	1897	1,181	367,383	1904	1,623	510,759
1891	884	274,000	1898	1,415	441,249	1905	1,886	688,328
1892	1,106	347,012	1899	1,676	523,203	1906	2,385	745,274
1893	874	270,930	1900	1,619	504,410	1907	2,210	691,757
1894	900	281,677	1901	1,857	581,051			

The following table shows the prices for Connellsville furnace and foundry cokes, by months, during the years 1903 to 1907. The abnormally high prices reported for both grades of coke in 1902 and 1903 was due to the scarcity of fuel caused by the strike in the anthracite region and were for prompt delivery, and although these prices were quoted and were actually obtained for coke sold for prompt delivery, the net returns to the producers in 1902 and 1903 were not so

large as in 1907, nearly all of the coke shipped in 1903 having been sold on contracts made months before, so that while it appears that prices for prompt delivery were quoted for furnace coke as high as $12 in 1902 and $7 in 1903, the average returns to the manufacturers was $2.28 in 1902 and $2.27 in 1903, whereas in 1907 the average price for the year of Connellsville coke was $2.32, the highest figure of which there is any record. The prices quoted in the following table are for strictly Connellsville coke as reported by The Iron Age. "Main line" and "outside" cokes are usually quoted from 15 to 25 cents below strict Connellsville:

Prices of Connellsville furnace and foundry coke, 1903–1907, by months.

Month.	Furnace.					
	1903.		1904.	1905.	1906.	1907.
	Six months' contracts.	Prompt delivery.				
Jan.	$3.75 to $4.00	$6.00 to $7.00	$1.60 to $1.65	$2.10 to $3.00	$2.15 to $2.75	$3.50 to $3.75
Feb.	3.50 to 4.00	4.50 to 5.50	1.50 to 1.65	2.00 to 2.75	2.10 to 2.50	3.50 to 3.65
Mar.	3.50 to 4.00	5.00 to 5.50	1.60 to 1.75	2.25 to 2.50	2.20 to 2.50	2.90 to 3.25
Apr.	3.75 to 4.00	4.50 to 5.00	1.60 to 1.65	1.90 to 2.25	2.30 to 2.75	2.65 to 2.85
May	3.00 to 3.50	3.50 to 4.00	1.60 to 1.65	1.80 to 2.00	2.30 to 2.75	2.00 to 2.85
June	2.75 to 3.00	2.75 to 3.50	1.40 to 1.65	1.75 to 2.10	2.30 to 2.50	1.75 to 2.65
July	2.50	2.50	1.40 to 1.50	1.75 to 2.10	2.40 to 2.75	2.40 to 2.60
Aug.	2.25 to 2.50	2.00 to 2.50	1.45 to 1.50	1.80 to 2.10	2.75 to 2.85	2.40 to 2.85
Sept.	2.25 to 2.50	2.00 to 2.50	1.40 to 1.50	1.90 to 2.50	2.85 to 2.90	2.75 to 2.90
Oct.	2.00 to 2.10	1.75 to 2.10	1.45 to 1.65	2.35 to 3.10	2.75 to 3.25	2.75 to 3.00
Nov.	.....	1.65 to 2.00	1.75 to 2.15	2.85 to 3.00	3.00 to 3.60	2.00 to 2.75
Dec.	.....	1.65 to 1.75	2.10 to 2.45	2.75 to 2.90	3.00 to 3.60	2.00 to 2.50

Month.	Foundry.					
	1903.[a]	1903.[b]	1904.	1905.	1906.	1907.
Jan.	$4.75 to $5.00	$6.00 to $7.50	$2.10 to $2.50	$2.25 to $2.75	$2.75 to $3.50	$4.00 to $4.50
Feb.	(c)	6.00 to 7.00	2.10 to 2.25	2.50 to 3.00	2.50 to 3.00	3.75 to 4.50
Mar.	(c)	6.00 to 7.00	2.10 to 2.50	2.75 to 3.25	2.75 to 3.25	3.50 to 4.00
Apr.	5.00	5.50 to 6.00	2.15 to 2.50	2.65 to 3.00	2.90 to 3.10	3.25 to 3.75
May	4.00	4.00 to 5.50	2.00 to 2.15	2.50 to 2.75	2.65 to 3.10	2.75 to 3.25
June	3.25 to 4.00	3.50 to 4.00	1.80 to 2.00	2.35 to 2.65	2.65 to 2.75	3.00 to 3.25
July	3.00 to 3.25	3.00 to 3.50	1.75 to 1.85	2.25 to 2.50	2.75 to 3.00	3.00 to 3.25
Aug.	3.00	3.00	1.75 to 1.85	2.25 to 2.50	3.00 to 3.25	3.00 to 3.75
Sept.	2.75 to 3.00	2.75 to 3.00	1.75 to 2.00	2.40 to 3.00	3.25 to 3.50	3.15 to 3.50
Oct.	2.75 to 3.00	2.75 to 3.00	1.80 to 2.25	2.75 to 3.50	3.25 to 4.00	3.25 to 3.40
Nov.	.....	2.50 to 2.65	2.00 to 2.50	3.50 to 4.00	3.75 to 4.50	2.50 to 3.00
Dec.	.....	2.15 to 2.50	2.25 to 2.50	3.40 to 4.00	3.75 to 4.50	2.50 to 2.75

[a] Contract prices. [b] Prompt delivery. [c] No contract prices quoted.

Greensburg district.—The ovens in the Greensburg district are all located in the vicinity of the city of Greensburg. There are 8 establishments in the district, and there were, at the close of 1907, 1,735 ovens in the district, of which only 10 were idle throughout the year. The total production in 1907 amounted to 798,003 short tons, as against 678,817 tons in 1906 and 551,233 in 1905. The value increased from $1,155,958 in 1905 to $1,641,473 in 1906 and to $2,273,078 in 1907. The average price per ton advanced from $2.42 in 1906 to $2.85 in 1907.

The statistics of the manufacture of coke in the Greensburg district, Pennsylvania, in 1889, 1890, 1900, and from 1903 to 1907 are given in the following table:

Statistics of the manufacture of coke in the Greensburg district, Pennsylvania, 1889–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1889	2	50	16	32,070	20,459	$21,523	$1.05	63.8
1890	2	58	0	44,000	30,261	44,290	1.46	68.7
1900	5	680	280	331,305	196,709	442,704	2.25	59.4
1903	7	1,332	0	813,216	451,385	1,477,134	3.27	55.5
1904	7	1,332	0	511,303	314,954	551,228	1.75	61.6
1905	7	1,328	100	908,003	551,233	1,155,958	2.10	60.7
1906	8	1,428	260	1,118,227	678,817	1,641,473	2.42	60.7
1907	8	1,735	0	1,206,981	798,003	2,273,078	2.85	66.1

Irwin district.—This district, which is of minor importance, includes 572 ovens, located near the town of Irwin in Westmoreland County. The production in 1907 was slightly less than that of 1906, the output declining from 230,552 short tons in 1906 to 210,393 tons in 1907, with a decrease from $510,572 to $492,304. In general sympathy with the advanced prices, however, the average price for coke in this district increased from $2.21 in 1906 to $2.34 in 1907. The Irwin district began manufacturing coke in 1889. The statistics of production in that year, in 1890, 1900, and from 1903 to 1907, have been as follows:

Statistics of the manufacture of coke in the Irwin district, Pennsylvania, 1889–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1889	4	696	0	373,913	243,448	$351,304	$1.44	65
1890	4	661	0	270,476	172,329	256,458	1.49	63.7
1900	5	697	0	93,647	61,630	153,743	2.49	65.8
1903	6	691	0	207,067	133,290	334,434	2.51	64.4
1904	6	691	0	14,468	8,793	14,576	1.66	60.8
1905	5	680	27	258,039	164,601	325,746	1.98	63.8
1906	5	581	0	348,007	230,552	510,572	2.21	66.2
1907	5	572	0	315,601	210,393	492,304	2.34	66.7

Lower Connellsville district.—This district, sometimes called the "Klondike," is located in the western part of Fayette County, immediately west of the southern end of the Connellsville basin, from which it is separated by the Greensburg anticline. Although but 8 years old, having been opened in 1900, it ranks next to Connellsville among the coke-making districts in the United States, having in 1906 and 1907 produced more than 3 times the output of the Flat Top district in Virginia and West Virginia, which until 1902 was the second coke-producing region in the United States. The development of this district surpasses all records in the United States, and the production has grown with phenomenal rapidity. Following the abnormal conditions in 1904 the production of coke in Pennsylvania showed a decrease in every district except the Lower Connellsville, which showed an increase in 1904 over 1903 of 558,158 short tons, while the total production of the State decreased 789,868 tons. The record for 1905 showed an increase of nearly 1,000,000 tons over 1904, and 1906 showed a gain of 1,300,000 over 1905. The statistics for 1907 show a further increase of 1,122,765 tons or 21.7 per cent over 1906 with an increase in value of $3,711,160 or 30.8 per cent. The 62 coking establishments in the district include 3 incomplete at the close of 1907. There was a total of 12,264 ovens completed and

1,068 building. None of the establishments except those which were incomplete were idle during 1907.

The record of the district for the eight years of its existence has been as follows:

Statistics of the manufacture of coke in the Lower Connellsville district, Pennsylvania, 1900–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1900	12	2,033	1,112	579,928	385,909	$792,886	$2.05	66.5
1901	17	3,251	30	1,666,826	1,116,379	1,991,699	1.78	66.9
1902	21	4,253	705	2,826,242	1,899,111	4,701,068	2.48	67.2
1903	32	5,753	786	3,452,568	2,329,298	5,522,884	2.37	67.5
1904	34	6,570	250	4,229,755	2,887,456	4,623,133	1.60	68.2
1905	45	7,484	1,145	5,666,812	3,871,310	7,532,382	1.95	68.3
1906	53	9,708	1,502	7,465,205	5,188,135	12,046,889	2.32	69.4
1907	62	12,264	1,068	9,150,693	6,310,900	15,758,049	2.50	69.0

Lebanon Valley and Schuylkill districts.—All of the by-product ovens in the Lebanon and Schuylkill valleys, which include 120 Semet-Solvay ovens at Steelton, 40 at Chester, 90 Semet-Solvay ovens at Lebanon, and 232 Otto-Hoffman ovens at Lebanon, were operated during 1907. The total production of these 4 plants in 1907 amounted to 909,188 short tons. In 1906, when the Semet-Solvay ovens at Chester and Steelton were not in operation, the production amounted to 559,601 short tons, and in 1905 the production was 297,716 short tons.

Pittsburg district.—A large part of the production of the Pittsburg district is from slack coal obtained from the mines along the slack-water navigation of the Monongahela River and is brought to Pittsburg on barges. Some run-of-mine coal is also brought from the fourth pool of the Monongahela River at Pittsburg. The production of 120 Otto-Hoffman ovens at Glassport and 25 Semet-Solvay ovens at Sharon, in Mercer County, is included in this district. The production in 1907 amounted to 1,764,747 short tons, valued at $5,183,156, against 1,463,795 short tons, valued at $3,620,030 in 1906, an increase of 300,952 tons or 20.6 per cent in quantity, and of $1,563,126 or 43.2 per cent in value. There are 12 establishments in the district with a total of 3,185 ovens. The only plant idle during 1907 was the Semet-Solvay plant of 25 ovens at Sharon.

The statistics of the manufacture of coke in the Pittsburg district for 1880, 1890, 1900, and from 1903 to 1907 are given in the following table:

Statistics of the manufacture of coke in the Pittsburg district, Pennsylvania, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	21	534	0	194,393	105,974	$254,500	$2.40	55
1890	14	541	0	149,230	93,984	171,465	1.82	63
1900	8	1,641	0	862,610	570,678	1,418,382	2.48	66.1
1903 [a]	9	1,636	359	1,404,660	877,640	2,632,827	3.00	62.5
1904 [a]	8	2,195	0	1,370,629	841,459	1,795,257	2.13	61.4
1905 [a]	8	2,226	380	2,317,159	1,463,774	3,599,436	2.46	63.2
1906 [a]	10	2,868	0	2,376,403	1,463,795	3,620,030	2.47	61.5
1907 [a]	[b] 12	[c] 3,185	0	2,807,931	1,764,747	5,183,156	2.94	62.9

[a] Includes ovens and production in Allegheny Valley district.
[b] Includes 2 establishments in Mercer County, 1 in Beaver County, and 2 in Allegheny Valley district.
[c] Includes 330 United Otto and 25 Semet-Solvay ovens.

Reynoldsville-Walston district.—This district, in Jefferson and Clearfield counties, includes all of the ovens along the line of the Rochester and Pittsburg Railroad, as well as those of the low-grade division of the Allegheny Valley Railway, and those connected with the mines of the New York Central and Hudson River Railway. The number of establishments in the district increased from 8 in 1906 to 9 in 1907. All of these were operated during 1907, and the production increased from 770,095 short tons in 1906 to 870,831 short tons in 1907, with an increase in value from $1,794,127 in 1906 to $2,386,678 in 1907. The average price per ton advanced from $2.33 to $2.74.

The following are the statistics of the manufacture of coke in the Reynoldsville-Walston district for the years 1880, 1890, 1900, and from 1903 to 1907:

Statistics of the manufacture of coke in the Reynoldsville-Walston district, Pennsylvania, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	3	117	0	45,055	28,090	$46,359	$1.65	62
1890	8	1,737	0	652,966	406,184	771,996	1.90	62
1900	7	2,010	0	1,115,923	625,553	1,347,869	2.15	56
1903	7	2,003	0	1,420,709	810,359	2,688,472	3.32	57.4
1904	8	2,101	200	1,313,507	709,502	1,585,950	2.24	54
1905	8	2,303	200	1,463,680	831,904	1,638,934	1.97	56.8
1906	8	2,502	0	1,399,801	770,095	1,794,127	2.33	55.8
1907	9	2,781	0	1,526,123	870,831	2,386,678	2.74	57.1

Upper Connellsville district.—This district includes that portion of the Connellsville trough or basin which lies north of a point a short distance south of the town of Latrobe, Westmoreland County. The coal of this district differs somewhat from that of the basin proper, so that in addition to its geographic position there is another reason for separating the production from that of the Connellsville district. The production in 1907 amounted to 1,030,260 short tons, valued at $2,457,072, against 1,011,229 short tons, valued at $2,172,748 in 1906, indicating a small increase in tonnage with a larger increase in value, the average price per ton having advanced from $2.15 in 1906 to $2.38 in 1907.

In the following table are given the statistics of the manufacture of coke in the Upper Connellsville district, Pennsylvania, in 1880, 1890, 1900, and from 1903 to 1907:

Statistics of the manufacture of coke in the Upper Connellsville district, Pennsylvania, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	8	757	0	319,927	229,433	$397,945	$1.73	72
1890	14	1,569	28	889,277	577,246	1,008,102	1.75	64.9
1900	14	1,999	0	1,042,170	690,449	1,378,629	2.00	66.2
1903	19	2,556	280	1,180,947	784,132	2,133,513	2.72	66.4
1904	19	2,660	27	601,236	390,540	590,097	1.51	64.9
1905	19	2,434	30	1,159,158	755,946	1,445,568	1.91	65.2
1906	22	2,516	332	1,497,285	1,011,229	2,172,748	2.15	67.5
1907	22	2,724	223	1,557,978	1,030,260	2,457,072	2.38	66.1

TENNESSEE.

The coke-making industry of Tennessee has remained nearly stationary in the last three years, the production in 1907 having amounted to 467,499 short tons, as compared with 483,428 tons in 1906, and 468,092 tons in 1905. The production of 1907 was within 5,507 tons of the average for the three years. In regard to the value of the product, however, there has been a decided increase, from $1,184,442 in 1905 to $1,350,856 in 1906 and to $1,592,225 in 1907. The average price per ton, which was as low as $2.39 in 1904, advanced to $2.53 in 1905, $2.79 in 1906, and $3.41 in 1907.

The total number of establishments in the State at the close of 1907 was 18, an increase of 1 over 1906. Of these 18 establishments 5, having a total of 769 ovens, were idle throughout the year. There was one establishment whose ovens were incomplete at the close of the year and did not contribute to the production during 1907. In 1906 there were 17 establishments, 3 of which, with a total of 536 ovens, were idle during the year. It appears from this that Tennessee did not participate in the general increased tonnage, though it did receive the benefit of the higher prices which prevailed during 1907. The 18 establishments in 1907 represented a total equipment of 2,806 ovens, compared with 2,731 in 1906. There were 80 ovens building at the close of the year.

The statistics of the manufacture of coke in Tennessee in the years 1880, 1890, 1900, and from 1903 to 1907 are shown in the following table:

Statistics of the manufacture of coke in Tennessee, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	6	656	68	217,656	130,609	$316,607	$2.42	60
1890	11	1,664	292	600,387	348,728	684,116	1.96	58
1900	14	2,107	340	854,789	475,432	1,269,555	2.67	55.6
1903	16	2,439	304	1,001,356	546,875	1,706,722	3.12	54.6
1904	17	2,436	190	718,181	379,240	905,540	2.39	52.8
1905	16	2,615	60	862,320	468,092	1,184,442	2.53	54.3
1906	17	2,731	138	929,405	483,428	1,350,856	2.79	52
1907	18	2,806	80	825,221	467,499	1,592,225	3.41	56.6

The character of coal used in the manufacture of coke in Tennessee has been for several years about equally divided between run of mine and slack. In 1907 the coal used consisted of 770,824 tons of washed coal. In addition to this there were 54,397 tons of unwashed run of mine. All of the slack was washed.

The following table exhibits the character of the coal used in the manufacture of coke in Tennessee in 1890, 1895, 1900, and from 1903 to 1907:

Character of coal used in the manufacture of coke in Tennessee, 1890–1907, in short tons.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	255,359	0	273,028	72,000	600,387
1895	96,744	59,284	285,906	242,721	684,655
1900	150,697	349,448	24,122	330,522	854,789
1903	157,717	404,949	74,560	364,130	1,001,356
1904	1,471	302,943	60,784	352,983	718,181
1905	134,432	244,302	46,073	437,513	862,320
1906	81,825	509,532	142,843	195,205	929,405
1907	54,397	386,094	0	384,730	825,221

UTAH.

As there is but one company in Utah engaged in the manufacture of coke the statistics of production have been included with those of the State of Colorado, which adjoins Utah on the east. The coals of Utah which are used in the manufacture of coke are practically identical in character with those of western Colorado.

VIRGINIA.

All of the coking coals of Virginia are contained within a few counties in the extreme southwestern portion of the State, which are within the coal fields of the Appalachian province. There has been considerable activity shown in the development of properties in the last few years, particularly in Wise and Lee counties, and although the production for 1907 was slightly less than in 1906, there is strong probability of a marked increase within a few years, particularly following the development of the work which has been in progress in the Black Mountain region of Lee County, which has been going on for the last two or three years. The decrease in 1907 was due to the monetary troubles in the latter part of the year, this region feeling the effects of the financial stress almost immediately. As it was, the production decreased from 1,577,659 in 1906 to 1,545,288 short tons in 1907, a loss of 32,379 tons or 2.1 per cent. Owing, however, to the better prices which prevailed during the greater part of the year the value of the coke produced in 1907 shows an increase of $154,074, or from $3,611,659 in 1906 to $3,765,733 in 1907. There were 19 establishments in 1907, an increase of 1 over 1906, and the total number of ovens increased from 4,641 to 5,333 in 1907. One establishment of 400 ovens was idle throughout the year, and this was due to the fact that the mines at Keokee are still in process of development. The Newton-Chambers ovens at Pocahontas, 56 in number, continued idle during 1907. The greater part of the development which has resulted in actual production during the last few years has been carried on in Wise County on the Clinch Valley branch of the Norfolk and Western Railroad. The coke in this district is the only coke at the present time made in Virginia from coal mined exclusively within the State. There are two plants in Virginia, one at Lowmoor and one at Covington, the coal for both of which is drawn from the mines in the New River district of West Virginia. The coals for the ovens at Pocahontas and part of the Flat Top district of Tazewell County is obtained from mines whose workings extend across the State boundary line into West Virginia and a part of this coal production should be properly credited to West Virginia. The openings of the mines, however, and the coke ovens, are in Tazewell County, and it is customary to credit the coal, as well as the coke, to Virginia. The total production of Wise County in 1907 amounted to 1,353,225 short tons, or 87.6 per cent of the total for the State.

The statistics of the manufacture of coke in Virginia in 1883, when the first operations were begun, and in 1890, 1900, and from 1903 to 1907, inclusive, are shown in the following table:

Statistics of the manufacture of coke in Virginia, 1883–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1883	1	200	0	39,000	25,340	$44,345	$1.75	65
1890	2	550	250	251,683	165,847	278,724	1.68	66
1900	7	[a] 2,331	300	1,083,827	685,156	1,464,556	2.14	63.2
1903	16	[a] 4,251	142	1,860,225	1,176,439	2,724,047	2.32	63.2
1904	16	[a] 4,345	68	1,636,905	1,101,716	1,772,717	1.61	67.3
1905	16	[a] 4,549	0	2,184,369	1,499,481	2,869,452	1.91	68.6
1906	18	[a] 4,641	695	2,296,227	1,577,659	3,611,659	2.29	68.7
1907	19	[a] 5,333	50	2,264,720	1,545,280	3,765,733	2.44	68.2

[a] Includes 56 Newton-Chambers by-product ovens.

All the coal used in the manufacture of coke in Virginia during 1907 was unwashed. Of the 2,264,720 tons used 1,271,518 tons were run-of-mine, and 993,202 tons were slack.

The following table shows the character of the coal used in coke making in Virginia in 1890, 1900, and from 1903 to 1907:

Character of coal used in the manufacture of coke in Virginia, 1890–1907, in short tons.

Year.	Run-of-mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	98,215	0	153,468	0	251,683
1900	620,207	0	463,620	0	1,083,827
1903	857,332	0	1,002,893	0	1,860,225
1904	1,213,226	44,222	379,457	0	1,636,905
1905	1,096,656	0	1,087,713	0	2,184,369
1906	1,014,299	228,347	1,053,581	0	2,296,227
1907	1,271,518	0	993,202	0	2,264,720

WASHINGTON.

Washington is the only one of the Pacific Coast States in which, so far as known, coking coals occur. The coking operations of Washington, when compared with those of some of the eastern States, are not of great importance, but they are of importance and of interest as establishing the fact that it is possible to make metallurgical coke from Pacific Coast coal. All the coking operations are in Pierce County in the central part of the State. There are five establishments in the State, four of which made coke in 1907. The only idle plant was a small, practically experimental establishment of 6 ovens. The other 4 establishments had a total equipment of 210 ovens, and the production in 1907 amounted to 52,028 short tons, valued at $293,019, against 45,642 short tons, valued at $226,977 in 1906. The average price per ton advanced from $4.99 in 1906 to $5.63 in 1907. All the coal used in coke making in Washington in 1907 was washed. Three of the plants used washed run-of-mine and one used washed slack.

The coke-making industry of Washington began in 1884, when 400 tons of coke were produced. The record since that time has been as follows:

Statistics of the manufacture of coke in Washington, 1884–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1884	1	0	0	700	400	$1,900	$4.75	57.5
1890	2	30	80	9,120	5,837	46,696	8.00	64
1900	2	90	0	54,310	33,387	160,165	4.80	61.5
1903	6	256	0	73,119	45,623	214,776	4.71	62.4
1904	6	256	0	76,993	45,432	207,357	4.56	59
1905	5	216	0	85,715	53,137	251,717	4.74	62
1906	5	216	0	76,896	45,642	226,977	4.99	59.4
1907	5	216	0	85,860	52,028	293,019	5.63	60.6

WEST VIRGINIA.

For a quarter of a century, during which the statistics of the coke production of the United States have been collected by the Geological Survey, and until the close of 1906 West Virginia and Alabama have been close rivals for second place among the coke-producing States and have frequently alternated with each other for the position. During 1907, however, there was a marked increase in the production of coke in West Virginia, while that of Alabama declined. As a result of this, the lead of over 800,000 which West Virginia maintained in 1905 and 1906 was increased to nearly 1,100,000 tons in 1907, and, as was stated in the report for 1906, the indications are that West Virginia will continue to rank next to Pennsylvania as a producer of coke. One of the factors which has added to the production of West Virginia has been the development of the Tug River district by the United States Coal and Coke Company, a subsidiary corporation of the United States Steel Corporation. The completion of the Coal and Coke Railway from Charleston to Elkins has opened up new coal areas in the central part of the State. It is anticipated that the Virginian Railway (formerly the Deepwater-Tidewater) will be completed during the year 1908, and this will give another outlet to tide water of the coal and coke of the southern part of the State. The completion of the Wabash interests (West Virginia Central and Pittsburg and Western Maryland railroads) will give outlet for the coals and cokes in the northern part of the State. In addition to these the older lines (Baltimore and Ohio, Norfolk and Western, and the Chesapeake and Ohio, have been building extensions to reach undeveloped coal areas, and all of this will tend to increase West Virginia's importance as a coal and coke producer. In the northwestern portion of the State immediate developments have followed the completion of the Morgantown and Kingwood Railroad, as is shown in the increased production in the Upper Monongahela district. It is perhaps unfortunate for the welfare of the State that the transportation facilities for carrying fuels out of the State are so excellent, as the railroads have been more interested in carrying coals and cokes to other markets than in building up manufacturing industries within the State's borders.

The coke production of West Virginia in 1907 amounted to 4,112,896 short tons, valued at $9,717,130, against 3,713,514 short

tons, valued at $8,192,956, in 1906, an increase of 399,382 tons or 10.75 per cent in quantity, and of $1,524,174 or 18.60 per cent in value. There were 142 establishments in the State in 1907, an increase of 1 over 1906. The total number of completed ovens in the State showed a decrease from 19,714 in 1906 to 19,688 in 1907. There were a number of new establishments started in 1907, but these were all but one offset by the permanent abandonment of some plants which had been idle for several years. The dismantling of these plants is also responsible for the decrease in the number of ovens. Most of the abandoned plants were in the Upper Monongahela district. Of the 142 establishments in the State in 1907, 26, with a total of 1,437 ovens, were idle. These idle establishments included 1, with a total of 173 completed and 7 incomplete at the end of the year, which had not been put into operation. The active establishments were therefore 116, with a total of 18,251 ovens. Of the 26 idle establishments 17, with a total of 916 ovens (including 73 completed but not in operation), were in the Upper Monongahela district, and 8, with a total of 421 ovens, were in the New River district.

The following table exhibits the statistics of coke production in West Virginia in 1880, 1890, 1900, and from 1903 to 1907:

Statistics of the manufacture of coke in West Virginia, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	18	631	40	230,758	138,755	$318,797	$2.30	60
1890	55	4,060	334	1,395,266	833,377	1,524,746	1.83	60
1900	106	[a]10,249	1,306	3,868,840	2,358,499	4,746,633	2.01	60.9
1903	136	[a]15,613	2,687	4,347,160	2,707,818	7,115,842	2.63	62.3
1904	137	[a]16,929	1,319	3,543,338	2,283,086	3,757,850	1.65	64.4
1905	143	[a]19,189	1,214	5,329,695	3,400,593	6,548,205	1.92	63.8
1906	141	[a]19,714	353	5,822,619	3,713,514	8,192,956	2.21	63.8
1907	142	[a]19,688	459	6,536,795	4,112,896	9,717,130	2.36	62.9

[a] Includes 120 Semet-Solvay ovens at Wheeling.

As shown in the following table, by far the larger part (62.1 per cent) of the coal used for coke making in West Virginia is slack, nearly all of which is used without being washed.

The character of the coal used in the manufacture of coke in West Virginia in 1890, 1895, 1900, and from 1903 to 1907 is shown in the following table:

Character of coal used in the manufacture of coke in West Virginia, 1890–1907, in short tons.

Year.	Run-of-mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	324,847	0	930,989	139,430	1,395,266
1895	405,725	24,054	1,476,003	182,034	2,087,816
1900	509,960	8,000	3,140,064	210,816	3,868,840
1903	1,149,761	3,000	2,890,310	304,089	4,347,160
1904	1,247,935	1,350	2,128,251	165,802	3,543,338
1905	1,445,099	1,950	3,577,793	304,853	5,329,695
1906	2,093,483	0	3,388,877	340,259	5,822,619
1907	2,451,811	27,067	3,874,817	183,100	6,536,795

PRODUCTION BY DISTRICTS.

It has been customary in the preceding reports of this series to consider the coke production by the districts into which the State has been divided. These districts are known, respectively, as the Upper Monongahela, the Upper Potomac, the Kanawha, the New River, and the Flat Top. The first two are in the northern part of the State, and are named from the fact that they are drained by the headwaters of the Monongahela and Potomac rivers. The other three districts are in the southern portion of the State. The New River district includes the ovens along the line of the Chesapeake and Ohio Railroad and its branches from Quinnimont to Hawks Nest, near which point the coals of the New River series go below water level. The Kanawha district embraces all of the ovens along the Kanawha River and its tributaries from Mount Carbon to the western limit of the coal fields. The ovens of the Gauley Mountain Coal Company at Ansted are included in the New River district, although the Ansted coal belongs in reality to the Kanawha series and lies about 1,000 feet above the New River coals. The Flat Top region is also drained by the upper portion of the New River, and includes the ovens in West Virginia which belong to the Pocahontas coal field. The Flat Top district is by far the most important and bears the same relation to the production of West Virginia that the Connellsville district bears to that of Pennsylvania. Since 1900 the statistics of production of the Flat Top district have included the new operations along Tug River lying west of and continuous with the Flat Top district. The output from this district averages something over 50 per cent of the total coke product of the State. The production of coke in 1907 increased in every district except the Tygarts Valley and Upper Potomac, in which districts a decrease of about 20,000 tons was shown. The largest increase was in the Flat Top district, which includes the Tug River, and this increase was largely in the Tug River section of the district. The next important increase was in the Kanawha district, and this gain is due to the operations at Page on the Tidewater branch of the Virginian Railway.

The statistics of the production of West Virginia by districts in 1906 and 1907 are shown in the following tables:

Production of coke in West Virginia in 1906 and 1907, by districts.

1906.

District.	Establishments.	Ovens. Built.	Ovens. Building.	Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
Flat Top[a]	56	11,872	200	2,985,931	1,912,595	$4,000,986	$2.09	64.1
Kanawha	12	1,605	50	582,260	358,903	860,514	2.40	61.6
New River	25	2,039	0	394,365	240,474	658,729	2.74	60.9
Upper Monongahela	37	[b]2,873	50	1,028,258	659,427	1,412,215	2.14	64.1
Upper Potomac and Tygarts Valley	11	1,325	53	831,805	542,115	1,260,512	2.33	65.1
Total	141	19,714	353	5,822,619	3,713,514	8,192,956	2.21	63.8

[a] Includes Tug River district. [b] Includes 120 Semet-Solvay ovens.

Production of coke in West Virginia in 1906 and 1907, by districts—Continued.

1907.

District.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
Flat Top [a]	55	11,613	50	3,436,902	2,193,064	$4,893,772	$2.23	63.8
Kanawha	12	1,660	202	739,724	451,043	1,168,888	2.59	61
New River	23	1,957	0	428,123	248,346	696,335	2.80	58
Upper Monongahela	40	[b] 2,983	107	1,107,659	698,345	1,738,464	2.49	63
Upper Potomac and Tygarts Valley	12	1,475	100	824,387	522,098	1,219,671	2.34	63.3
Total	142	19,688	459	6,536,795	4,112,896	9,717,130	2.36	62.9

[a] Includes Tug River district. [b] Includes 120 Semet-Solvay ovens.

Flat Top district.—Until the close of 1902 this district was, next to the Connellsville district of Pennsylvania, the most important coke-producing region of the United States, but the largely increased production of the Lower Connellsville, or Klondike, district of Pennsylvania in 1902 placed that district above the Flat Top as a coke producer. Like the coal of the Connellsville region, that of the Flat Top district of West Virginia produces a coke which makes an ideal blast-furnace fuel. Chemically, the Flat Top coke is superior to that of Connellsville, as it is lower in mineral content or ash, and it is regarded by some ironmasters as equal in physical properties to the Connellsville coke.

To the operations of the Flat Top district has been added that of the Tug River district, immediately to the west, in which the United States Coal and Coke Company has completed something over 2,000 ovens. The combined production of the Flat Top and Tug River districts in 1907 amounted to 2,193,064 short tons, valued at $4,893,772, an increase of 280,469 tons, or 14.7 per cent, in quantity and of $892,786, or 22.3 per cent, in value over the production of 1906. The Flat Top district really includes the coal mining and coke-making operations in Tazewell County, Va., and if this is added the total production for the district in 1907 amounted to 2,385,119 short tons.

The Flat Top district began producing in 1886. The output of the West Virginia portion of the district for 1890, and for that of the West Virginia Flat Top and Tug River districts in 1900 and from 1903 to 1907, has been as follows:

Statistics of the manufacture of coke in the Flat Top district of West Virginia, 1886–1907.

Year.	Establishments	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1886	2	10	38	1,075	658	$1,316	$2.00	61.2
1890	17	1,584	252	566,118	325,576	571,239	1.75	57.5
1900 [a]	38	5,290	666	1,952,274	1,208,838	2,290,947	1.90	61.9
1903	51	8,994	1,329	2,094,127	1,314,758	3,126,512	2.38	62.8
1904	53	10,023	684	2,024,055	1,320,314	1,928,871	1.46	65.2
1905	56	11,287	1,074	3,162,820	2,042,123	3,604,923	1.77	64.6
1906	56	11,872	200	2,985,931	1,912,595	4,000,986	2.09	64.1
1907	55	11,613	50	3,436,902	2,193,064	4,893,772	2.23	63.8

[a] Includes establishments in the Tug River district since 1900.

New River district.—This district includes the ovens along the Chesapeake and Ohio Railroad and the New River from Quinnimont on the east to the junction of the New and Gauley rivers on the west. The ovens at Ansted on Gauley Mountain are included in this district, although the coal belongs by right to the Kanawha series. The coals of the New River district are for the most part high-grade coking coals, and the coke is a good blast-furnace fuel. It is also a high-grade steaming coal, nearly smokeless in character, and the demand for it as a steam coal is probably responsible for the somewhat backward tendency shown by the coke production during the last few years. Two establishments in the New River district were abandoned during 1907, reducing the number from 25 to 23, and the total number of ovens was reduced from 2,039 to 1,957. Of the 23 establishments in 1907, 8, with a total of 421 ovens, were idle, leaving 15 active establishments, with a total of 1,536 ovens, which produced in 1907 248,346 tons of coke valued at $696,335, against 240,474 tons, valued at $658,729 in 1906. The average price per ton advanced from $2.74 in 1906 to $2.80 in 1907.

The statistics of the manufacture of coke in the New River district in 1880, 1890, 1900, and from 1903 to 1907, have been as follows:

Statistics of the manufacture of coke in the New River district, West Virginia, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	6	468	40	159,032	98,427	$239,977	$2.14	62
1890	12	773	4	275,458	174,295	377,847	2.17	63
1900	27	1,722	560	568,856	341,527	750,637	2.20	60
1903	28	2,243	500	619,230	368,844	1,129,701	3.06	59.5
1904	26	2,156	18	387,265	233,014	439,521	1.89	60.2
1905	25	2,129	0	514,850	301,626	622,815	2.06	58.6
1906	25	2,039	0	394,365	240,474	658,729	2.74	60.9
1907	23	1,957	0	428,123	248,346	696,335	2.80	58

Kanawha district.—The Kanawha district includes all of the ovens along the banks of the Kanawha River from its formation by the junction of the New and Gauley rivers to the western limits of the coal fields. It also includes the recent developments on the Virginian (Deepwater-Tidewater) Railroad along lower Loup Creek, and the inclusion of this latter factor is responsible for the marked increases in production in 1905, 1906, and 1907. The output of the district had decreased from 179,988 tons in 1903 to 92,014 tons in 1904. As a result of the bringing in of the Loup Creek production, the output in 1905 increased to 249,251 tons. This was further increased in 1906 to 358,903 tons, and again in 1907 to 451,043 tons. The increase in 1907 over 1906 was 92,140 tons, or 25.7 per cent. The value increased $308,374, or 35.8 per cent. There were 12 establishments in the district in 1907 and in 1906. Only one of these establishments in 1907 was idle, and this was one in which the ovens were entirely new and had not been completed before the close of the year.

The statistics of the manufacture of coke in the Kanawha district in 1880, 1890, 1900, and from 1903 to 1907, have been as follows:

Statistics of the manufacture of coke in the Kanawha district, West Virginia, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	4	18	0	6,789	4,300	$9,890	$2.30	63.3
1890	6	474	0	182,340	104,076	196,583	1.89	57
1900	11	847	80	291,277	165,339	412,636	2.50	56.7
1903	13	967	321	296,552	179,988	567,308	3.15	60.7
1904	14	1,112	600	152,517	92,014	142,858	1.55	60.3
1905	14	1,617	0	415,808	249,251	504,734	2.03	60
1906	12	1,605	50	582,260	358,903	860,514	2.40	61.6
1907	12	1,660	202	739,724	451,043	1,168,888	2.59	61

Upper Monongahela district.—This district embraces coke ovens in the counties of Harrison, Marion, and Taylor, and derives its name from the fact that the region is drained by the headwaters of the Monongahela River. It includes the well-known mining regions in the vicinity of Clarksburg and Fairmont, which are among the most important in the State.

There were 40 establishments in the Upper Monongahela district, with a total of 2,983 completed ovens at the close of 1907. Of these 40 establishments 17, with a total of 916 ovens, were idle during the year. The idle ovens included 73 new ovens which had not been put in blast. The production increased from 659,427 tons, valued at $1,412,215, in 1906, to 698,345 tons, valued at $1,738,464, in 1907. The average price per ton advanced from $2.14 in 1906 to $2.49 in 1907.

The statistics of coke production in the Upper Monongahela district in 1880, 1890, 1900, and from 1903 to 1907, are shown in the following table:

Statistics of the manufacture of coke in the Upper Monongahela district, West Virginia, 1880–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1880	8	145	0	64,937	36,028	$68,930	$1.91	55
1890	18	1,051	50	276,367	167,459	260,574	1.56	60
1900	24	[a] 1,563	0	584,265	355,861	817,340	2.30	60.9
1903	37	[a] 2,319	337	724,915	437,522	1,315,336	3.01	60.3
1904	37	[a] 2,348	17	478,513	328,820	749,305	2.28	68.7
1905	39	[a] 2,861	90	576,201	389,213	965,402	2.48	67.5
1906	37	[a] 2,873	50	1,028,258	659,427	1,412,215	2.14	64.1
1907	40	[a] 2,983	107	1,107,659	698,345	1,738,464	2.49	63

[a] Includes 120 Semet-Solvay ovens at Wheeling.

Upper Potomac and Tygarts Valley district.—The Upper Potomac district includes the ovens along the line of the West Virginia Central and Pittsburg Railroad, in the region drained by the upper waters of the Potomac River. The statistics since 1902 include also the operations of some new ovens in the Tygarts Valley just below the Ohio-

Potomac divide, but practically continuous with the Upper Potomac district. The number of establishments in this district increased from 11 in 1906 to 12 in 1907, and the number of completed ovens from 1,325 to 1,475, but the production decreased from 542,115 short tons in 1906 to 522,098 tons in 1907. The value decreased from $1,260,512 in 1906 to $1,219,671 in 1907. This is the only district in the State in which a decreased production was reported in 1907. One small establishment was abandoned during 1907 and one new plant was added. The ovens of the latter, however, were not completed before the end of the year. All of the other establishments were in operation during 1907.

The statistics of the manufacture of coke in the Upper Potomac and Tygarts Valley district in 1887, 1890, 1900, and from 1903 to 1907, are shown in the following table:

Statistics of the manufacture of coke in the Upper Potomac and Tygarts Valley district, West Virginia, 1887–1907.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1887	1	20	50	3,565	2,211	$4,422	$2.00	62
1890	2	178	28	94,983	61,971	118,503	1.91	65
1900	6	827	0	472,168	286,934	475,073	1.66	60.8
1903	7	1,090	200	612,336	406,706	976,985	2.40	66.4
1904	7	1,290	0	500,988	308,924	497,295	1.61	61.7
1905	9	1,295	50	660,016	418,380	850,331	2.03	63.4
1906	11	1,325	53	831,805	542,115	1,260,512	2.33	65.1
1907	12	1,475	100	824,387	522,098	1,219,671	2.34	63.3

OTHER STATES.

In the following table are presented the statistics of production of coke in the years 1900 to 1907 of those States in which there are but one or two establishments. These States are Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, and Wisconsin. Of the several States included in this statement, 6—Maryland, Michigan, Minnesota, New Jersey, New York, and Wisconsin—produced coke made from coal mined in other States, while 1—Massachusetts—obtained its chief supply of coal from Nova Scotia and smaller quantities from West Virginia. All of the ovens in Maryland, Massachusetts, Minnesota, New Jersey, New York, and Michigan are by-product retort ovens, and one of the two establishments in Wisconsin is also a by-product recovery plant. All of the ovens in Wyoming were abandoned in 1907, and this reduced the number of establishments in the following table from 12 to 11 and the total number of ovens from 1,952 to 1,878. The total combined production of the States included in the following table increased from 2,085,617 in 1906 to 2,528,739 tons in 1907, and the value increased from $7,474,889 in 1906 to $10,302,269 in 1907.

The statistics of production in the States having less than three establishments since 1900 are shown in the following table:

Statistics of coke production from 1900 to 1907 in States having only one or two establishments.

Year.	Establishments.	Ovens.		Coal used (short tons).	Coke produced (short tons).	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke (per cent).
		Built.	Building.					
1900	10	832	594	708,295	506,730	$1,454,029	$2.87	71.5
1901	11	862	609	793,187	564,191	1,607,476	2.849	71
1902	11	898	742	852,977	598,869	2,063,894	3.446	70.2
1903	17	1,308	760	1,306,707	932,428	3,228,064	3.46	71.3
1904	14	1,753	658	2,046,340	1,469,845	4,830,621	3.286	71.8
1905	12	1,666	145	2,222,723	1,660,857	5,500,337	3.31	74.7
1906	12	1,952	0	2,861,934	2,085,617	7,474,889	3.58	72.9
1907	11	[a] 1,878	0	3,415,723	2,528,739	10,302,269	4.07	74

[a] Includes 350 Semet-Solvay, 1,018 United Otto, and 282 Rothberg ovens.

Of the total production of 2,528,739 short tons in 1907, shown in the preceding table, 2,429,795 short tons, or 96.09 per cent, were made in by-product retort ovens. This is a little less than half of the total production of by-product coke in 1907.

RECENT LITERATURE REFERRING TO THE MANUFACTURE OF COKE.

As the subject of the manufacture of coke is not, strictly speaking, a subject of geological investigation, the Geological Survey reports on this subject are restricted chiefly to the volumes of Mineral Resources and to reports on the testing of the coking qualities of certain coals by the fuel-testing plant of the Geological Survey at St. Louis during the Exposition period, and since that time by the Technologic Branch of the Survey. The results of these tests are contained in the following Survey publications:

Bulletin 261. Preliminary report on the operations of the coal-testing plant at St. Louis during the Exposition period.

Professional Paper 48. Final report on the operations of the coal-testing plant at St. Louis during the Exposition period.

Bulletin 290. Preliminary report on the operations of the fuel-testing plant at St. Louis during 1905, subsequent to the Exposition period.

Bulletin 332. Report of the fuel-testing plant at St. Louis January 1, 1906, to June 30, 1907.

Bulletin 336. Washing and coking tests of coal and cupola tests of coke at the fuel-testing plant, St. Louis, Mo., January 1, 1905, to June 30, 1907.

Following is a list of contributions to literature on the subject which have appeared recently in the technical journals:

By-product coke as made in ovens of the Otto-Hoffmann and United-Otto system, with description of the plant at Camden, N. J., by Edwin A. Moore: Paper read before the Philadelphia Foundrymen's Association, February 1, 1905; published in Mines and Minerals July, 1905.

The manufacture of coke in Northern China: Illustrated description of methods employed at the Kaiping and other collieries; published in the Bi-Monthly Bulletin, American Institute of Mining Engineers, November, 1905.

By-product coke ovens: Paper read before the Engineers' Club of Philadelphia and published in the proceedings of the club for July, 1906, and in the Black Diamond, August 25, 1906.

By-product coke and the Huessener by-product coke oven: Paper read before the British Institution of Mining Engineers, published in the Iron and Coal Trades Review, London, June 15, 1906; abstracted in Mines and Minerals of Scranton, Pa., August, 1906.

The Koppers coke oven system: Paper by Herbst, in Glückauf, August 6, 1906—an illustrated article dealing with the general arrangement of the Koppers type of coke ovens; abstracted in Mines and Minerals for April, 1907.

Qualities of beehive and by-product cokes: Paper, by Robert Buchanan, read before the Cleveland Institution of Engineers, England, giving relative values of beehive and by-product cokes, London Mining World, March, 16, 1907.

Manufacture of coke from western coal: Paper by R. S. Moss in the Mining World, June 8, 1907—explains improvements claimed to have been made with the Hemingway coking process.

Coke drawing machines: Paper read before the Engineers Society of Western Pennsylvania, by Walter W. Macfarren, and published with illustrations in the Coal Trade Bulletin of April 15, 1908, the Industrial World of December 2, 1907, and the Iron Trade Review of December 26, 1907.

The Marmac coke drawing and loading machine: An illustrated description of this machine published in The Iron Age, December 26, 1907.

The Ernst coal charging machine: An illustrated description of machine for charging in Belgian ovens, published in The Iron Age, December 12, 1907.

Plant of modern Belgian type ovens: Illustrated description of plant under construction by the Connellsville Central Coke Company in the Connellsville district of Pennsylvania, by W. B. Robinson, published in The Iron Trade Review of Cleveland; abstracted in the Coal Trade Bulletin, December 2, 1907.

The Koppers coke oven: An illustrated description of the Koppers retort ovens under construction at Joliet, Ill.; published in The Iron Age, December 12, 1907,

By-product coke ovens at Joliet, Ill.: A brief description of the Koppers ovens under construction by the Illinois Steel Company at Joliet; published in The Iron Age, October 17, 1907.

Retort versus beehive coke ovens: Paper showing comparison of first costs and of economies in operation, by Alfred Ernst, Pittsburg; published in The Iron Age, January 6, 1908.

The Sheldon retort coke oven and process: An illustrated article describing the Sheldon retort oven, by S. B. Sheldon, Buffalo, N. Y.; published in The Iron Age, January 16, 1908.

The Von Bauer coke oven system: An illustrated description of the Von Bauer type of by-product coke oven; published in The Iron Age, February 27, 1908.

Present status of the by-product coke oven in the United States: Paper by C. G. Atwater, giving the quantity of coke and the various by-products produced in 1906; published in Mines and Minerals, February, 1908.

The Hebb coke drawing machine: An illustrated description of the Hebb coke drawing machine; published in The Iron Age, April 23, 1908.

Transition in coke making: An illustrated description of new forms of ovens and machines for quenching and drawing coke and leveling coke in ovens, by William L. Affelder; published in Mines and Minerals, May, 1908.

Making coke from Indiana coal: Description of the beehive coke oven plant near Linton, Greene County; published in the Engineering and Mining Journal, May 20, 1908.

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